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A THEORY OF MEDICAL HISTORIOGRAPHY

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I

Almost a decade ago Emil Lederer, the German economist, in his *Aufriss der Oekonomischen Theorie* made the following statement:

"There is no Economic History without the use of theoretical conceptions. How can I describe facts, without putting them into an order, and how can I put them into an order without distinct points of view which alone enable me to create such an order? How much work on Economic History has largely been wasted because it did not rest on the sound foundation of an appropriate system. No wonder, that some work on Economic History turned out to be a mere description of the institutions of individual states and their administration. If authors do not base their descriptions on theoretical conceptions, economic facts cannot be systematised and their development cannot be comprehended."

This quotation bears pertinently on our subject, for here in a nutshell is the central problem of all historiography.

While the task of writing history comprises basically the statement of the time-distribution of events, yet a mere chronological collection of events is not properly historiography. An understand-

ing of the implications of this statement requires an analysis of the nature of History. According to Hegel it comprises both the *res gestas* and the *historiam rerum gestarum*. In other words, History presents a two-fold aspect; on the one hand it is the sum total of *past events*, while on the other it is the *recording* of this past activity. These two basic components of History underlie any historical study, and find their objective expression in the two fundamental activities of the historian—analysis and synthesis.

Analysis is the research of history, the endeavor to discover facts by scientific study and critical investigation of source materials. *Synthesis*, on the other hand, is the writing of history, the attempt to collect the results of analysis into a coherent arrangement. History is most generally defined, therefore, as the study and recording of past reality.

The investigation of any aspect of reality, no matter whether past or present, whether in the realm of animate or inanimate nature, involves two basic elements—*experience* and *cognition*. The former may be defined as the totality of apprehended data, the latter as the interpretation of this material. While experience and cognition can be distinguished in a formal sense, the maintenance of a rigid dichotomy is untenable in a particular case, since these two elements are mutually interdependent and interactive. Experience and cognition are the polar terms of a dynamic totality—the process of investigation.

The relation of these considerations to the field of history is readily apparent, for analysis and synthesis are obviously but special aspects of the general categories, experience and cognition. In terms of this definition the writing of history must be regarded as the expression of the historian's cognition of experience. Thus, in the broadest sense, the central problem of historiography is a problem of cognition.

While the historian, as an investigator of past reality, is as much concerned with the establishment of isolated events as with groups of events, yet as a writer of history the confirmation of isolated facts is quite inadequate for a proper fulfillment of his task. To produce an intelligible picture of the past, events must be gathered into a connected and coherent whole. In other words, the estab-

lished facts must be arranged in a particular order or pattern. The basic operation employed in creating an order or pattern is grouping. For this purpose the data obtained by the historian must be selected and presented in a definite sequence. Obviously such operations are not based upon chance, but result from the interaction of several specific factors.

The selection and arrangement of historical facts into an intelligible pattern is determined in the first place by the nature and extent of the problem under investigation. Innumerable variations in degree exist between the problems of " societies which have greater extension in Space and Time than national states, or city states, or any other political communities," which A. J. Toynbee regards as " the intelligible fields for human study," and the minutely small time-space sectors that occupy the attention of other historians. It is evident that an investigator studying the genesis of cultures in time and space will employ a type of order quite different from that required in an investigation of the English infant welfare movement during the 18th century.

A second factor determining the type of order employed by the historian is the character of the available factual evidence. This may vary both qualitatively and quantitatively, depending on a variety of circumstances. To a large extent such variations are due to the nature of the problem itself. A study of industrial disease in classical antiquity would obviously yield but meager results in comparison with an investigation of political events during the same period.

Finally, the third and probably the most significant factor becomes apparent when we consider the historical problem and its place within the historical investigation. Historical problems are studied to ascertain information regarding aspects of past reality. In other words, a problem may be regarded as an unanswered question and its investigation as an attempt to arrive at an answer. Seen in this light, the historian's statement of the question, or approach to the problem, is obviously very significant for the course of his investigation. There can be little doubt that the nature of this approach, i. e. the historian's conception of his problem, is an important factor in determining the character of his results. The choice of a certain type of approach also introduces an element of selection which

undoubtedly exerts a significant influence on the direction of the investigation.

Evidently, then the arrangement of apprehended data into a specific pattern is related to the historian's approach to his investigation, since this factor determines broadly the kind of information sought by the historian, and in consequence also the boundaries of his problem. This does not mean, however, that his investigation may not lead him far afield from his original starting point, or that the information uncovered in the course of his research may not alter his previous conception of the problem. Nevertheless, the important thing to remember is that every historian approaches a problem from a distinct point of view, and that this view-point whether changed or unchanged by his researches, has a distinct bearing on the historian's treatment of the data ascertained during his investigation.

In view of this general analysis it is clear that in all historical writing the treatment of the subject is to a large extent a function of the approach. The significance of this relationship is due to the circumstance that intellectual attitudes are an expression of underlying ideas. In their totality they form the ideological basis of the historian's activities, including his selection and arrangement of available historical facts. Since this body of ideas serves to connect all the ascertained facts into a coherent whole, and in this manner to explain them, it obviously performs the function of a theory of history and must be regarded as such. At the same time, it is evident that the production of an intelligible and coherent sequence or order is an act of cognition. Thus the writing of history as the objective expression of historical cognition must be viewed as reflecting the theoretical "pre-conceptions" of the historian. The foregoing analysis has clearly indicated the important rôle of cognition and its ideological basis in the writing of history. It is therefore perfectly obvious that the theory of cognition employed by the historian is a matter of great consequence, since a theory of historiography is in essence a theory of historical cognition.

II

Any attempt to establish the validity of certain theoretical "preconceptions" for the writing of medical history must be based first of all upon a definite conception of the nature of medicine. Stripped of all secondary accretions, medicine is essentially a body of knowledge and skills resulting from the behavior of certain individuals in relation to their fellows under specific circumstances. In other words, medicine is the product of a specific social activity, namely, of the attempts of men to deal with the needs of their sick fellows. This essentially social nature of medicine was recognized very early. Hippocrates in his "Ancient Medicine" describes as follows the origins of medicine: "For the art of medicine would never have been discovered to begin with, nor would any medical research have been conducted—for there would have been no need for medicine—if sick men had profited by the same mode of living and regimen as the food, drink, and mode of living of men in health, and if there had been no other things for the sick better than these. But the fact is that sheer necessity has caused men to seek and to find medicine, because sick men did not, and do not, profit by the same regimen as do men in health."

This activity is founded upon a definite social relationship. The basic figures in this relationship are the *patient* and the *physician*; its character is determined by the factor to which this association owes it origin—*disease*. It is this element which links these two individuals, and furnishes the common ground upon which they meet within their specific relationship. In its simplest form this association may be presented as follows: Patient—Disease—Physician, where the arrows indicate the complementary and mutual character of the elements forming the poles of the relationship. On the basis of this analysis it is clear that the history of medicine may be regarded as the history of three fundamental interrelated problem areas, namely those centered respectively around the patient, the physician, and disease.

Yet such a static morphologic view is inadequate and one-sided. Since medicine, as stated above, is the product of a need, it must

obviously also be the result of a response to this need. The very nature of this need makes it evident that the response will be active in character. In other words, medicine must also be regarded as the product of a constant *necessity for action* resulting from the very nature of the "patient-physician" relationship. Regarded from this point of view, it becomes apparent that any historical study of medicine must take into account this dynamic character. A moment's consideration of the above analysis will reveal yet another aspect of the subject. By the very nature of its origin medical activity is essentially practical and directed towards a definite end. This functional element which plays so important a rôle in medicine as an expression of its basic character must of necessity loom large in an investigation of medical activity.

Having established the existence of these fundamental strands in the fabric of medicine, it now becomes necessary to consider it in time and space, in other words, to look at medicine, as history. While the basic function of medicine has remained the same through the ages, its instrumental expressions have varied greatly. The medicine of any given period is characterized by particular institutions, modes of behavior, ideas, and skills. Yet these manifestations are never fixed and immutable. Medicine like all other forms of human activity exhibits movement in time, expressing itself as diversity produced by change. Obviously, then, any serious study of the history of medicine must necessarily concern itself, either implicitly or explicitly, with this problem of change.

Yet the problem of change cannot be approached while medicine is regarded as an independent entity, presumably suspended like Mohammed's coffin between heaven and earth. Medicine as an expression of human behavior cannot be studied in isolation. Since it is but one of the many phases of man's activity as a social being, the development of medicine in time can be studied best and comprehended most fully only by investigating it in relation to the changes of the social structure as a whole. It is only on the basis of this recognition of the essential interdependence of all human endeavor and activity that the medical historian can arrive at an adequate theoretical approach to his subject.

The implications of the foregoing general analysis become appar-

ent when it is applied to the fundamental structural elements of the basic medical relationship, namely " Patient-Disease-Physician." It is obvious that the relations of these three elements within their association are of a specific character, i. e. they are created for a definite purpose. Indeed, from this point of view the relationship must be regarded as a functional system. But it is likewise obvious that its origin is far from being a creation *ex nihilo*. All three basic elements, the patient, the physician, and the disease cannot be abstracted from their particular time-space environment. Individually and in their collective relationship they form an integral part of a definite cultural landscape, whether it be ancient Greece, Renaissance Italy, or 19th century Germany. Certain phenomena of any given period may of course be isolated and thus studied. This analytic type of investigation must be supplemented, however, by another kind of research which attempts to study these individual manifestations in relation to whole groups of phenomena. The necessity for this type of study is clear if each of our basic elements—patient, physician, disease—is considered not simply as a discrete point in a static time-space framework, but rather as a nodal point within a dynamic time-space continuum.

Such a description is of course only an analogy. In terms of social architectonics it may be phrased as follows: Each element of the basic medical relationship presents two aspects, a microcosmic one, i. e. in relation to the other medical elements, and a macrocosmic one, in relation to the other phases of the social structure. Thus an individual is not only a patient, but also a slave or a free man, an industrial worker or a business man, a citizen of a democratic commonwealth or the subject of an autocratic state. Similarly, a disease is not simply an immutable entity, something with which patients are afflicted throughout the ages; this is only part of the story. Disease is not alone a biological but also a *social* phenomenon, and therefore completely comprehensible at any given time only within its biological *and* social context. The syphilis of the Renaissance was not syphilis as we know it to-day. Tuberculosis is another example. The " fistula club " mentioned by Thackrah in 1832 is comprehensible only with reference to the conditions created in early 19th century England by the Industrial Revolution. Thus the form presented by

each of the three elements in any given historical period can be regarded as a product of the interaction of the microcosmic forces within the medical relationship and the macrocosmic forces of the external social environment.

On the basis of this proposition each element may be described, both in its microcosmic and macrocosmic aspects, as a function of environmental facts and the relations between these facts. The factors in the particular environment of which the element is a function can be regarded as constituting a social field organized in terms of the relationship between these facts. This viewpoint requires the study of patient, physician, and disease as part of a social field thereby including not only the medical aspects, but also the political, economic, technologic, etc.

But a social field is not simply a sector of a given society structured in a particular manner. Society is a dynamic thing, constantly and incessantly changing. It is a process, an active state of flux, manifesting itself in a continuous series of social transitions. These changes, however, do not occur at random but in a definite order, in a time sequence. Obviously then, social phenomena are in the profoundest sense also historical phenomena. It can be said that the social field as a part of society, participating in the social process, is subject to the same considerations as the social structure in its totality. Consequently the study of change in medical history must be undertaken as a study of the dynamics of social fields, requiring the investigation of the multifold processes transpiring within and among the social fields of the basic medical relationship and of those other elements of society that impinge upon it. It must be pointed out, however, that the interactions of these various elements should not be conceived in simple mechanical terms of action and reaction, but rather as a complex of transpiring dialectical processes. If we may borrow an analogy from physico-chemical science, the aptest comparison would be with the internal state of, or the relations existing within an heterogeneous phase system.

III

At this point that question may well be asked: What does this theoretical analysis mean in terms of the actual writing of medical history? Up to our own day the history of medicine has been dominated by the bio-bibliographical trend established during the Renaissance. Written for the most part by physicians for members of their own profession it is no wonder that medical history centered about the physician and the problems in which he was interested. However, as we have pointed out, medicine is not an autonomous body of knowledge that concerns only the physician, but rather a product of social action resulting from a social relationship that cannot be studied outside its context. Seen from this point of view it is clear that there must be a definite shift of emphasis in the work of the medical historian with a consequent expansion of the scope of his task. It is no longer sufficient for the medical historian to present a connected and unified account of the development of medical knowledge in time and to let it go at that. He must penetrate deeper into his subject and attempt to account for the predominant characteristics and aspects of medicine in any historical period on the basis of comparative and genetic studies of the progress of medicine *in society*. From the point of view of this conception of medical history there is a wide field for study. Without attempting any systematic presentation we may consider some of the problems that become apparent in the history of medicine.

How much do we actually know about the *institutions* of medicine? For example, where is there to be found a history of the development of *private practice* in our modern Western society based upon free exchange; who has worked out the effect of economic institutions and trends on the practice of medicine? Another line of investigation lies in tracing the rôle of *competition* as an objective social institution in the development of medicine. To what extent has free competition prevailed in medical practice at various times and what have been its effects? When is free competition replaced by regulation; is such regulation voluntary or authoritarian?

One of the most prominent and significant phenomena of modern

medicine is specialization. But where have we had any attempt to study the processes, both within the medical profession and in society as a whole, that have led to the appearance and extension of specialization in medicine. To be sure, various " chronicles " of particular specialties have appeared, but no study has yet been made to determine the processes of " immanent " development within a particular specialty as well as the contemporaneous social processes that were effective in the same direction, to ascertain, if possible, the interrelation of the two sets of processes, and to determine the social consequences of specialization. Only by attacking such questions can the medical historian attempt to account for the predominant problems of modern medicine.

Another problem demanding investigation is the study of medicine from the viewpoint of the patient as a " consumer " of medical care. How has the patient selected his physician in different historical periods; what has the patient expected of the physician? What has been the influence of lay opinion on the physician and his attitude toward the patient? Every period has some standard by which the fundamentals of good medical care are established. It is important to trace the evolution of such standards in terms of their social and economic backgrounds. What relation do they bear to the class structures of the societies in which they exist? It is such questions which should receive the attention of the medical historian.

A bare enumeration of all the problems that arise from this conception of medical history goes beyond the limits of this paper, but attention should be called to still one other set of problems requiring study, namely, those centering around the history of disease.

Historical investigation of this subject has generally been based, either consciously or unconsciously, upon the underlying ontological conception that the patient, to paraphrase Charcot, is only an accident in the history of the disease. At first sight this taxonomic, nosographic approach may seem quite logical and appropriate, particularly to the physician. And yet a moment's consideration of this premise in terms of our analysis of medicine must surely reveal its essential limitations, for a disease is not simply the totality of symptomatic phenomena in time and space. On the contrary symptoms of disease are simply the expression of an altered reaction

modus in an individual. Diseases are therefore not independent entities but abstract conceptual categories that represent changing phenomenological aspects of certain dynamic processes occurring in organisms. Attention must consequently be centered upon the individual organism, the patient, with the result that the historical study of disease assumes a new aspect. Since the diseased individual is a human being, the history of disease must begin and end with human beings; it must be a history of men.

Man, however, is a social being. Men live not only by acting upon Nature, but also upon each other. They enter into certain relations with each other, thus furnishing a framework within which social activity can proceed. It becomes necessary therefore in studying an individual or group not to disrupt the connexions which bind the object under investigation to its environment.

Applying this approach to the historical study of disease, it is obvious that the object to be investigated is not alone the development of theoretical or factual knowledge of any particular disease, but rather the study of sick people located within a definite space-time setting under particular social conditions. In other words, disease is a cultural manifestation (using culture in the anthropological sense) of man as a social being. Health conditions, and this includes both the qualitative and quantitative aspects of health, are as integral an aspect of a society as its economics, politics, religion, or art. Regarded from this point of view the strictly medical aspects of disease are no longer isolated phenomena but rather aspects or functions of a greater social whole.

To be sure such an approach may not be applied with equal facility to all types of disease, and it is possible that those cases most likely to produce fruitful results will be investigated first. Thus, the subject of occupational disease, by its very nature seems suitable for such treatment.

Space forbids the further elaboration of specific topics and problems, but perhaps enough has been said to indicate the importance of studying the history of medicine within and not apart from the human society of which it forms such an integral and significant part.

MISCONCEPTION OF A UTOPIA

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So long as they are content to know something of the Republic *and the earlier dialogues, Platonism must be a sealed book to them.*
—BURNET.

"For every Doctor Pangloss who finds all for the best in this best of possible worlds, there are a hundred who feel that things could hardly be worse. Ninety-nine of these express their dissatisfaction by grumbling against Providence or by booting the cat over the door-sill, but the hundredth devises a Utopia in his thoughts, and sometimes even sets it down on paper. . . .

"The earliest of the ideal commonwealths we shall consider was the *Republic* of Plato. . . . A medical audience should have as little patience as Mr. Douglas with Plato's 'twilight world of abstractions' and with his hatred of a fact." [1]

These and the subsequent statements of their author, together with the remarks *ad loc.* of Dr. Ramsay Spillman, bring nothing less than dismay to the Platonist not only, but also to one who, like the writer, without being a Platonist is nevertheless a lover of Plato.

In evaluating the statements of Mr. Silvette and the remarks of Dr. Spillman, it is essential first of all to repeat the fact, well known to serious students of the subject, that there are fundamental distinctions between the philosophy of Socrates and the philosophy of Plato. To accumulate all of the evidence bearing upon this fact would require several volumes, but it is at hand if needed. The essential point is simply, as Professor Burnet remarked, that Platonism must remain a sealed book to those who have been content to know something of the *Republic*, the *Symposium*, and possibly the *Phædo* and the *Apology*; and for these, and especially for such as pride themselves upon the supposed scientific superiority of Aristotle and their own supposed Aristotelian love of a fact, it should be enough to point out that Aristotle it was who referred to the speakers in the *Phædo* as those "who first said there were forms," [2] and

[1] Herbert Silvette: "Medicine in Utopia," *Bull. Hist. Med.*, VII, 1013 (Nov.), 1939.

[2] Aristotle: *Met.*, 1078[b], 11.

that on this very fact of admitting the existence of forms he distinguished them from Plato. Now the discussion of the forms in the *Republic* [3] is complementary to the discussion of them in the *Phædo*; the conclusion is that the *Republic* is not Platonic but Socratic. It follows then that the implied accusation of misanthropy and dissatisfaction is not applicable to Plato, at least on the grounds stated. It can be proved easily that it is not applicable to Plato on any ground—not even after the disillusion which he is known to have experienced at the outcome of his effort to convert Dionysius of Syracuse—but this proof will be passed over in order to show that such a charge cannot be sustained even against Socrates, whose philosophy it is which is expounded in the *Republic*.

In the *Symposium* Socrates is shown as a man who anticipates with purely human joy the good food, the good drink, and the good companionship attendant upon a banquet of this kind. After the sudden rapture which makes him late, he enters the house of Agathon in the gayest of spirits, and in a festal array which would have been entirely unbecoming a misanthropist.[4] The conversational byplay is a pleasant thing to him, and the suggestion of Eryximachus and Phædrus pleases him completely. And here, as Professor Taylor has pointed out, "As with other great mystics, Socrates' otherworldliness is compatible with being 'a man of the world' in the best sense and knowing how to adapt himself readily to the mood of the gayest companies." [5] And again, "He moves through a brilliant and loose-living society like a Sir Galahad, not because he is not a man of genuine flesh and blood, but because his heart is engaged elsewhere. . . . Socrates' remarkable power of adapting himself in appearance to the tone and manner of the world, and yet contriving without any visible effort to bring with him the suggestion of being all the while in constant contact with the other 'unseen' world which is at once so near and so far is one of the best-known characteristics of the greatest 'contemplatives'; . . . (The same 'adaptability' is noted as eminently distinctive of Xavier by his biographers.

[3] *Republic, e. g.* 507 and 596.

[4] Following the best critics and scholars, I accept the Socratic dialogues (*i. e.*, those up to and including the *Republic*) as intending to portray Socrates historically.

[5] A. E. Taylor: *Plato: The Man and His Work*, IX (p. 212).

Xavier recalls Socrates too by the 'gaiety' of which the biographers speak as the most striking feature of his conversation.)"

A dozen other examples of the basic humanity of the man rise to mind: his action in the field at Potidæa, at Delium, at Amphipolis; his real pleasure in the company of Charmides, Phædrus, and Theætetus; his genuine admiration of the great Sophist, Gorgias; the incomparable eulogy by the incomparable Aristophanes. But aside from these examples and yet others, one would find great difficulty in maintaining that Socrates was the opposite of the Leibnizian optimist in the face of the memorable passage where he tells of his disappointment upon reading the book of Anaxagoras.[6] "They [Archelaus, Thales, Anaximander, Anaximenes, Pythagoras, Alcmæon, Diogenes of Apollonia, Empedocles, and others] explained everything mechanically, whereas Sokrates wished to be shown that everything is as it is because it is best for it to be so."[7] And his great complaint against Anaxagoras was just that Anaxagoras (or, possibly, Hermotimus of Clazomenæ) had conceived a noetic formal principle of being which could explain the existence of the cosmos conceived as good, and then had been unable to make use of this principle, the only one which Socrates knew could fill the need.

The *Republic*, then, in the very first place, is not a Utopia devised and set down on paper by the nine thousand nine hundred and first dissatisfied grumbler against Providence or booter of the cat over the door-sill, who feels that things could hardly be worse. And as for the charge of being "impermanent," it may be observed in passing that the *Republic* has outlived not only all real states, but even all ideal ones, and outlived them

Where life most lives, e'en in the tongues of men.

"A medical audience should have as little patience as Mr. Douglas with Plato's 'twilight world of abstractions' and with his hatred of a fact," continues Mr. Silvette; "Most of us have discarded, if indeed the medical profession has ever fully subscribed to the

[6] *Phædo*, 96.

[7] John Burnet: *Greek Philosophy, Part I: Thales to Plato*, VIII (p. 133). Cf. also Taylor, *Plato: the Man and His Work*, p. 200, and *Phædo*, 96.

Platonic 'know thyself.' Our idea of virtue is to investigate patiently the facts of life."

It may be observed—patiently, as a "fact of life," but again in passing—that the "know thyself" is not Platonic, nor even Socratic, but Delphic.

As for the "twilight world of abstractions" and the "hatred of a fact" which have been attributed to Plato—nothing but the most desperate ignorance of the life and the labour of the Academy during Plato's own scholarchy, nothing but the most high-handed neglect of a patient investigation of the facts of life, could account for misstatements like these.

A telling example of Plato's reverence of a fact, and a telling example of his patient investigation of the facts of life—and similarly of the facts which transcend human life—is to be found in his reconstitution of the Pythagorean mathematic. The Pythagorean geometry was erected upon the axiom of the indivisible point, a unit having position; and the arithmetic upon the axiom that the unit, 1, is the origin of the integers, the system of the natural numbers. The great Parmenides, however, worked out his monistic philosophy against the doctrines of the pluralists, and worked it out so completely that it attained the limits of its possible development in his own mind (this is proved by the fact that the effort made by Melissus of Samos to develop further the Parmenidean monism brought it directly to the pluralistic atomism of Leucippus and Democritus). Zeno of Elea accepted the monism of his master and adoptive father and, aware of the fact that its evolution was complete, sought only to uphold it by demonstrating that any pluralistic doctrine led to inconsistencies and absurdities. He did this, moreover, with extraordinary brilliance and with devastating success. Against the Pythagorean geometry he proved that it is impossible to bisect a line made up of points. Against the Pythagorean arithmetic he evolved the whole theory of irrational numbers—numbers like π and $\sqrt{2}$, which are inexpressible in terms of the Pythagorean unit.

When the exodus of philosophers from Athens occurred, following the death of Socrates, Plato and some, at least, of his friends became the guests of Euclid of Megara. Plato resided in Megara, possibly with some interruptions, for about ten years, and during

that time he became aware of the necessity for a reconstitution of mathematic in a form which the Benonian criticism, adopted by the Megarians, who considered themselves the true representatives of the Eleatic philosophy, could not touch. This reconstitution of mathematic, then, was one of the chief labours to which Plato devoted himself after the founding of the Academy, and its accomplishment is still one of the most brilliant achievements of man. The solutions to the two specific difficulties mentioned were contained in the famous doctrine that geometrical figures are generated by rhesis, and in the yet more famous doctrine that the numbers are not addible. It is doubtful whether the human mind ever displayed a deeper reverence for fact than did Plato's for the fact of geometrical bisection against the peerless dialectic of Zeno, or whether any more patient investigation of facts than that of forty years by the clearest minds of Hellas ever was undertaken.

Again, Mr. Silvette states, "If, as Coleridge once observed, all men are born either Platonists or Aristotelians, then few physicians are in the former category"; and he adds, in a note, "Dr. Ramsay Spillman of New York, who discussed this paper, made the penetrating observation that the distinction between Aristotelianism and Platonism is of fundamental importance to the medical profession, for it is the difference between science and the cults."

Science and the cults indeed! Plato observed that the natural motion of telluric bodies was in a straight line, and if the motions of the celestial bodies were curvilinear that was because something was interfering with their rectilinear motions. Aristotle, on the other hand, stated that the curvilinear motions of the celestial bodies were explained by the fact that they are composed of a fifth element beside the four sublunary ones, fire, air, water, and earth,—a quintessence, whose natural motion was curvilinear. Thereby he opposed to the scientific astronomy of Plato the cult of the quintessence. The Aristotelian cult, together with its evolution in Averroës and Avicenna, was one of the prime causes of the astrology, the numerology, and the thaumaturgy from which the modern world has not yet shaken itself loose—witness the obvious deference to Aristotle by Mr. Silvette and Dr. Spillman. "In what are generally regarded as his [Aristotle's] most important works, everything is made to

depend upon the spherical earth being at rest in the center of the universe, while the starry heavens go round it once in twenty-four hours. Now there can be no doubt that the Academy had already gone far beyond this, and that it was the reactionary astronomy of Aristotle that kept that science back till the Renaissance, when Copernicus and Galileo renewed the study of it by going back to the Platonic view, which has held the field ever since. On this side, then, Aristotle was merely a reactionary and delayed the progress of science for centuries." [8] If, therefore, it be true that few physicians are Platonists, that is so much the worse for medicine.

Plato's aim was stated by Mr. Silvette to be "to turn his citizens into perfect philosophers by so breeding and educating them that they arrived at maturity with perfect souls." The aim stated by Plato in the *Republic*, however, is different from this. The inhabitants of the state were divided naturally into three classes and the individuals of each class were to be bred and educated to the duties of their class: the fighters to the development of the virtue of courage, the citizens to that of the virtue of temperance, and the rulers to that of the virtue of wisdom. Moreover, the rulers were to invent the pious fiction of the men of gold, of silver, and of bronze, and only in the most exceptional of cases would it be possible for a soldier or a citizen to become a philosopher. It would, however, be possible in exceptional cases, and this is evidence that the *Republic* does not advocate the caste system. And in connexion with these class distinctions which are recognised in the *Republic*, another misconception comes to light. Mr. Silvette writes, "He [Bacon] had no sympathy with the revolutionary communistic principles of Plato, More and Campanella, and favored a benevolent monarchy in which private property and class distinctions occupied a significant place." That class distinctions occupied a significant place in the *Republic* has just been shown, and is, moreover, self-evident from the whole structure of the argument. On the charge of communism one can do no better than quote Prof. Taylor:

"In spite of all that has been said about the 'socialism' or 'communism' of the *Republic*, there is really neither socialism nor communism to be found in the work. The current confusions on the point are probably due mainly to

[8] John Burnet: *Platonism*. University of California Press, 1928.

the mistaken notion that the emphatic demand of Book IV. for the banishment of 'wealth' and 'penury' from society must be the proposal of a communist, or at least of a socialist. This assumption is, on the face of it, absurd. . . . In point of fact, nothing much is said in the book about the economic organization of the only class who have any economic function at all, the δημιουργοί, but the implication of what is said is that there are differences of wealth among them, and the 'means of production and distribution' are individually owned and operated." [9]

Bosanquet also has shown that it is not private ownership, but plutocracy, which Socrates wanted to prevent. Again, in the *Laws* Plato asserted private ownership so determinately that a man's fields are to be an inalienable patrimony, and may not even be worked in common.[10]

The private ownership of property, then, and the distinction of class do occupy a significant place in the *Republic*. Again, there is no communism in Plato's state, but even if there were it would not have been revolutionary but only an adaptation of what already existed in Sparta. It only remains to show that Plato—Socrates, really—really favoured a benevolent monarchy and feared only that a human monarch could not be benevolent; this demonstration is to be found in what is perhaps the most frequently quoted passage in the whole work, and surely one of the most frequently quoted in the whole of Greek literature, a passage which the veriest stripling in the humanities could be expected to know:

Until philosophers are kings, or the kings and princes of this world have the spirit and power of philosophy, and political greatness and wisdom meet in one, and those commoner natures who pursue either to the exclusion of the other are compelled to stand aside, cities will never have rest from their evils,—no, nor the human race, as I believe,—and then only will this our State have a possibility of life and behold the light of day.

"It has been said," continues Mr. Silvette, "That all Utopias are impracticable because they take into account everything but human nature." Yet it was precisely because Plato—Socrates, really—took human nature into account that he relinquished his ideal of benevolent monarchy.

Mr. Silvette's notion of Plato's Academy seems borrowed, for the

[9] A. E. Taylor, *op. cit.*, XI, 276 *s.*

[10] *Laws*, 740ᵃ *s.*

most part, from Mr. Douglas: " Plato it was who first set his mind to make men better by ' choice dissertations about utopias.' He was the first, in Mr. Norman Douglas's words, ' to sit in marble halls and have a fair and fondly ardent *jeunesse dorée* reclining about [his] knees while [he] discoursed, in rounded periods concerning the salvation of their souls by means of transcendental Love,' " he quotes " with approval." This, by inference, is contrasted with the Aristotelian scientific spirit.

I make no apology for quoting Professor Taylor on this point, as probably the foremost living Platonic scholar:

> The founding of the Academy is the turning-point in Plato's life, and in some ways the most memorable event in the history of Western European science. . . . He was henceforth to be the first president of a permanent institution for the prosecution of science by original research. . . . The novel thing about the Platonic Academy was that it was an institution for the prosecution of *scientific* study. Isocrates, like Plato, believed in training young men for public life. But unlike Plato he held the opinion of the " man in the street " about the uselessness of science. . . . Plato's rival scheme meant the practical application to education of the conviction which had become permanent with him that the hope of the world depends on the union of political power and genuine science. This is why the pure mathematics—the one department of sheer hard thinking which had attained any serious development in the fourth century B. C.—formed the backbone of the curriculum, and why in the latter part of the century the two types of men who were successfully turned out in the Academy were original mathematicians and skilled legislators and administrators (these would be the fair and fondly ardent *jeunesse dorée,* no doubt) . . . It was one of Plato's firmest convictions that nothing really worth knowing can be learned by merely listening to ' instruction "; the only true method of " learning " science is that of being actually engaged, in company with a more advanced mind, in the discovery of scientific truth (and this would be the rounded periods and transcendental Love, doubtless).

It would seem superfluous to add anything to this. If there be any still who side with Messrs. Douglas and Silvette and with Dr. Spillman, it may be permissible to point out that Zeller gives a more or less complete roster of the members of Plato's Academy. In this list will be found the names of nearly all of the greatest men of Plato's and the succeeding generation, from Demosthenes and Lycurgus and Hyperides to Aristotle himself, who found it impossible to scale the peaks of the science of Plato—law-givers, statesmen,

orators, mathematicians, astronomers, philosophers, scientists, and soldiers, and even, as Professor Burnet has remarked, a fair share of tyrants—" a fair and fondly ardent *jeunesse dorée*! "

" The physician who settled in the town [Athens]," continues Dr. Silvette, " . . . would have found flourishing among its inhabitants a kind of Christian Science sanctified by the state. Plato's aim was to turn his citizens into perfect philosophers by so breeding and educating them that they arrived at maturity with perfect souls. And a good soul, said Plato, by its virtue renders the body the best which is possible. In a word, a sound or a sick soul meant a sound or a sick body, and no sick souls were allowed. It seems never to have seriously entered his mind that the converse proposition might contain even more truth: the sounder the body, the sounder the soul."

The aim which is stated in the *Republic*, however, is not to turn the citizens into perfect philosophers, but into perfect farmers, builders, weavers, shoemakers, for

> . . . we are not all alike; there are diversities of natures among us which are adapted to different occupations.
>
> Very true
>
> And will you have a work better done when the workman has many occupations, or when he has only one?
>
> When he has only one.[11]

> . . . in our State, and in our State only, we shall find a shoemaker to be a shoemaker and not a pilot also, and a husbandman to be a husbandman and not a dicast also, and a soldier a soldier and not a trader also.[12]

The aim stated is to turn the citizens into perfect carpenters, smiths, neatherds, shepherds, and other herdsmen, traders, merchants, sailors,—even salesmen![13] and hunters, actors, *poets*, rhapsodists, players, dancers, contractors, couturiers, servants, tutors, nurses, tirewomen, barbers, confectioners, cooks, swineherds, and physicians.[14]

Physicians!—as one of the facts of life which apparently has suffered more from hatred than from patient investigation at the hands of the modernist " Aristotelians," it may be pointed out once

[11] *Republic*, 370 (Jowett tr.). [12] *Republic*, 397. [13] *Republic*, 371.
[14] *Republic*, 373 (the italics are mine: see the next paragraph).

for all that in the whole of the extant writings of Plato there is no passage which can be interpreted to mean that "there should be no such skillful sons of Aesculapius in *his* Republic," nor again that "In his Republic Plato will have neither poets nor physicians within the city walls," [15] nor even that Plato held physicians and medicine in anything less than highest esteem. This, too, should dispose of Mr. Silvette's judgement that "Plato . . . found the medical practice of his day too efficient for the good of the commonwealth." Also, his statement, "It is necessary to recognize the incompatibility of Plato and Physic, for when this is clear his lowly opinion of physicians may be properly discounted," may in turn properly be discounted. Again, neither Plato nor Socrates wished to found a state without poets:

> But there is another sort of character who will narrate anything, and, the worse he is, the more unscrupulous he will be; nothing will be too bad for him: and he will be ready to imitate anything, not as a joke, but in right good earnest, and before a large company. As I was just now saying, he will attempt to represent the roll of thunder, the noise of wind and hail, or the creaking of wheels, and pulleys, and the various sounds of flutes, pipes, trumpets, and all sorts of instruments: he will bark like a dog, bleat like a sheep, or crow like a cock; his entire art will consist in imitation of voice and gesture, and there will be very little narrative. . . .
>
> And therefore when any one of these pantomimic gentlemen, who are so clever that they can imitate anything, comes to us, and makes a proposal to exhibit himself and his poetry, we will fall down and worship him as a sweet and holy and wonderful being; but we must also inform him that in our State such as he are not permitted to exist; the law will not allow them. And so when we have anointed him with myrrh, and set a garland of wool upon his head, we shall send him away to another city.[16]

In interpreting Plato it is well to refer to Plato's own words. Plato always displays the highest admiration for the poet; it is the "pantomimic gentleman" who is to be banished.

". . . Plato felt that there was no greater mark of a bad city than the need of physicians and hospitals," states Mr. Silvette. But what Plato actually said was that there could be no greater proof of "a bad and disgraceful state of education" than that a liberal education should not include a basic knowledge of law and medicine,

[15] Herbert Silvette, *op. cit.*, pp. 1017, 1014.
[16] *Republic*, 397, 398.

excepting that men should come to love litigiousness and " to require the help of medicine, not when a wound has to be cured, or on occasion of an epidemic [Plato nowhere calls an epidemic " a lapse from virtue only on the part of the gods," as Mr. Silvette implies he does] but just because, by indolence and a habit of life such as we have been describing, men fill themselves with waters and winds, as if their bodies were a marsh, compelling the ingenious sons of Asclepius to find more names for diseases." [17] Hospitals are not mentioned by Plato, but

> . . . Ought there not to be good physicians in a State, and are not the best those who have treated the greatest number of constitutions good and bad? and are not the best judges in like manner those who are acquainted with all sorts of moral natures?
>
> Yes, I said, I too would have good judges and good physicians.[18]

Such a statement—and there are many others—does not seem to be very helpful to " a kind of Christian Science." Mr. Silvette's strange conception of the Platonic relation between the body and the soul seems to be the result of his decision to " dispense with Plato's philosophical subtleties regarding the relationship between the body and the soul "—and he adds, parenthetically, " Mr. Douglas has called them ' distracted dialectics.' " He continues, " And a good soul, said Plato, by its virtue renders the body the best which is possible "; but what Plato actually said is " The good soul, by her own excellence, improves the body *as far as this may be possible*." [19] Mr. Silvette thinks this is " a kind of Christian Science " or a philosophical sublety, or perhaps even " distracted dialectics." Let us see: Plato continues (and it is worth noting that he is talking not about the citizens in general, but only about the soldiers [guardians, or auxiliaries [20]]),

> Then, to the mind when adequately trained, we shall be right in handing over the more particular care of the body. . . .
>
> Very good
>
> That they must abstain from intoxication has been already remarked by us; for of all persons a guardian (*sic*) should be the last to get drunk and not know where in the world he is. . . . A finer sort of training [in diet and

[17] *Republic*, 405 (Jowett tr.).
[18] *Republic*, 408.
[19] *Republic*, 403 (italics mine).
[20] *Republic*, 414: ἐπίκουροι.

gymnastic, than that of the athletes] will be required for our warrior athletes, who are to be like wakeful dogs, and to see and hear with the utmost keenness; amid the many changes of water and also of food, of summer heat and winter cold, which they will have to endure when on a campaign, they must not be liable to break down in health.[21]

And Socrates continues, prohibiting fish and boiled meats (because they require too many utensils), sweet sauces, Syracusan dinners, the refinements of Sicilian cookery, the delicacies of Athenian confectionery, and a Corinthian girl as the soldier's fair friend. For "simplicity in gymnastic is the parent of health in the body." These soldiers are not to be turned into "perfect philosophers," but into "lean wiry dogs" "able to fight with two or three times their own number." [22]

In misquoting Plato on the relation of the soul to the body Mr. Silvette adds, "It seems never to have seriously entered his mind that the converse proposition might contain even more truth: the sounder the body, the sounder the soul." As a matter of fact, however, Plato said, "The very (physical) exercises and toils which he (the musician) undergoes are intended to stimulate the spirited element of his nature, and not to increase his strength," [23] and the whole following passage, which is neither distracted nor subtle, is a discussion of the development of the virtues of courage and temperance through a system of education which gives due and proper attention to both sides of man's nature.

Mr. Silvette writes, "He [Plato] insinuates that Aesculapius, by means of gold, was prevailed upon to cure a dying rich man for which he was struck by a thunderbolt. . . . Plato has twisted the fable to serve as a double attack upon the God of Medicine."

The *Republic* most probably was written about 385 B. C. The third Pythian Ode of Pindar was composed probably in 474 and gives the story of Æsculapius as it is found in the *Republic*. If the fable was twisted, then, it was twisted almost a century before Plato told it, and probably much earlier, and Plato had it from Pindar, a

[21] *Republic*, 403, 404.

[22] *Republic*, 422. These are the words of Socrates. It may be noted that they describe his own life.

[23] *Republic*, 410.

good authority. Moreover, the most cursory reading of the passage will show that Plato has not told the story "to serve as a double attack upon the God of Medicine" at all, but as a reason for "purging" poetry and tragedy of impiousness.

As for Mr. Silvette's reproaching Plato because he "cold-bloodedly let the chronic ones [cases] die," the passage in question is this:

> . . . bodies which disease had penetrated through and through he (Asclepius) would not have attempted to cure by gradual processes of evacuation and infusion: he did not want to lengthen out good-for-nothing lives, or to have weak fathers begetting weaker sons;—if a man was not able to live in the ordinary way he had no business to cure him; for such a cure would have been of no use either to himself, or to the State.[24]

Euthanasia for the hopelessly afflicted and sterilisation of the defective are subjects which still command able protagonists. This offers no ground for Mr. Silvette's judgment that Plato "misinterpreted the function of the physicians of his own time."

And at any rate, one should know by now what judgement to pass upon a criticism of the *Republic* from a man who speaks of "the skilful sophistry of Plato," who thinks of the Academy as a luxurious *jeunesse dorée*, and who finds "welcome relief" in turning from a work which the judgement of the world during more than twenty centuries has crowned as one of the very greatest masterpieces of literary art. This was indeed an Icarian effort.

[24] *Republic*, 407.

AMERICAN AND EUROPEAN MEDICINE IN THE EIGHTEENTH CENTURY

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In few fields of scientific enterprise in the eighteenth century did Americans feel so much the equal of Europeans as they did in medicine. In the early years of the eighteenth century medical education was of a very uncertain character in America, and even in Europe a large proportion of the physicians had gained their knowledge by a short apprenticeship to a doctor who might serve on occasion as an apothecary. The word "doctor," itself, seems to have secured no general American usage until about 1760. It should be noted that this apprenticeship system in America had certain advantages. It gave American students practical instruction in the sick room when their European contemporaries were heavily emphasizing theoretical medicine. The tendency in America was also to train the student in both medicine and surgery whereas in Europe for the most part a strong antagonism still prevailed between these two fields.[1] But Americans had much to learn and with the exodus of youths to Edinburgh and other European medical centers that began after the middle of the eighteenth century a great improvement in education and practice is quickly observable in the colonies.

Beginning with John Moultrie in 1749, forty-one colonials registered at Edinburgh before 1775, fourteen of whom indicated their arrival from Virginia. The Revolution placed no obstacle in the way of American students intending for Scotland, and between 1776 and 1800, seventy-six more young men registered at Edinburgh, of whom thirty said they came from Virginia. In pre-revolutionary days students named the colony whence they had come, although at the time of the Stamp Act, Samuel Bard from New York, and two or three others called themselves Americans. As time went on more

* The writer gratefully acknowledges the aid granted him by the Social Science Research Council.

[1] H. E. Sigerist, "Boerhaave's Influence upon American Medicine," *Nederl. Tijdschrift voor geneeskunde*, Jaargang 82, no. 40 (Oct. 1938).

and more overseas students registered as Americans, but the pride of the Old Dominion continued to express itself to a late day in the registration of prospective doctors who signified they had come from Virginia.[2]

Noted Americans provided students with letters of introduction to sympathetic guardians on the other side of the Atlantic. Dr. Robert Whytt, a specialist in studies of the nervous system, took care of young Samuel Bard, who had come recommended by Dr. Cadwalader Colden of New York. To his sponsor, Bard communicated information of his progress and added an acknowledgment of Colden's instruction in botany which now stood him in good stead. Sir Hans Sloane was on familiar terms with many Americans and it was to him that Dr. Zabdiel Boylston of Boston commended his son. The young man intended to study medicine in London.[3] Everywhere Franklin lent assistance to young students, and during one of his sojourns in England he was able to smooth the path for Shippen, Rush, John Morgan and others. The kindly physician John Fothergill was the particular guardian for these Americans. Morgan and Rush came under his watchful eye and Benjamin Waterhouse, later the distinguished, if somewhat eccentric, Harvard professor, began his studies in England under the same supervision.[4] Waterhouse, when visiting the medical center at Leyden, wrote Franklin that he intended to practice in Boston, and added his belief that it was not necessary for men to go to Europe in order to cure the diseases of their next-door neighbor. Characteristically he wrote at the same time that he had learned much during his stay with his relative, Dr. Fothergill. The latter expressed the hope to Franklin that Waterhouse might some day teach in the projected Massachusetts College of Medicine, but Fothergill thought him as yet too young and inexperienced.[5] Dr. John Pringle was another who was held in high regard by Ameri-

[2] *New Eng. Hist. and Genealog. Reg.*, vol. 42, p. 159 et seq.

[3] *Sloane Mss.*, Dec. 19, 1737, 4055 f., 248.

[4] *Colden Papers, N. Y. Hist. Soc.*, VI, 219; *Thomson Papers, N. Y. Hist. Soc., Coll.*, 1878, p. 17; Pepper, *The Medical Side of Benj. Franklin*, 41-44; Fox, *Dr. John Fothergill and his Friends*, 371, 375.

[5] *Cal. of Franklin Papers*, II, Dec. 16, 1780, Dec. 25, 1780.

can doctors and his advice in various matters was sought, with Franklin acting as an intermediary. When the well-known Philadelphian, Dr. Thomas Bond, was contemplating sending his son Richard abroad to complete his medical studies, the elder Bond desired Dr. Pringle's advice on the comparative merits of the schools in Edinburgh, Paris, London, Leyden and Vienna.[6] In later years Dr. John Coakley Lettsom was the guide for many Americans and when they in turn achieved professional distinction they affectionately remembered his kindly aid.[7] In the private offices of distinguished surgeons and from experience gained from service in English hospitals young Americans, such as P. S. Physick, fitted themselves for careers of eminence.[8] John Hunter, the man who Osler thought combined the qualities of Vesalius, Harvey and Morgagni, had a great influence on American surgeons who were vigorous exponents of his methods. Thomas Chalkley James, reputed to be the foremost obstetrician of his time, was one of Hunter's many students.[9]

Even before students began to return from European medical schools, the colonial Americans had made some efforts to create societies to publish communications or to establish systematic courses of lectures. In his early days in Philadelphia, Colden suggested a course of medical lectures, but the learning dispensed by Dr. John Kearsley, Sr., in his local office, was the nearest approximation to a systematic education. The elder Kearsley seems to have been a successful mentor, for his students included the most famous colonial physicians, William Shippen Sr., Cadwalader Evans, John Bard, John Kearsley Jr., and John Redman. As a result of the initiative

[6] *Cal. of Franklin Papers*, II, July 6, 1771.

[7] T. J. Pettigrew, *Memoirs of John Coakley Lettsom with . . . Correspondence* (London, 1817), vol. I, pp. 100-101; see B. S. Barton, *Collections for an Essay toward a Materia Medica of the United States* (Part second, Phila., 1804), dedicated to Lettsom.

[8] Sir D'Arcy Power, "How the tradition of American surgery came to America," *Trans. of the Amer. Surgical Assn.*, vol. 42 (1924), pp. 23-24; Sir William Osler, *The Evolution of Modern Medicine*, pp. 196-197.

[9] J. M. T. Finney, "The Influence of John Hunter upon early American surgery" (delivered before Hunterian Society, London, Jan. 17, 1927), ms. copy in possession of Mr. Mortimer Woolf of the Hunterian Society; Packard (1931 edn.), II, pp. 992-993.

of men like Colden, Dr. William Douglass and others scattered through the colonies, a number of medical societies were established about the middle of the century.[10]

But these haphazard means of gaining a medical education were incapable of satisfying the demands of a growing professional class that was already conscious of its importance in the community. It was at Edinburgh that the American medical schools were born in the minds of Shippen, Morgan and Samuel Bard, fellow students. Bard wrote to his father of the proposals of his companions to start a school in Philadelphia. He was sorry that they were not to live in New York, but he saw no reason why a similar institution should not be established in his own city. Both plans waited on the passage of time, but individuals were already holding classes in various colonial towns. Before his return to Philadelphia, Dr. William Shippen 2nd, who had studied with John Hunter, had been urged by Fothergill to give a course of anatomical lectures; these he delivered with the aid of drawings supplied by his English guide.[11] Dr. William Hunter, related to the more famous London brothers of the like name, gave some lectures in Rhode Island. In Boston and New York dissections by experienced physicians were made for the instruction of some students, but for some time to come prejudice on both sides of the Atlantic opposed such realistic medical teaching. Plans for a Harvard medical school that had been proposed before the Revolution, inspired in large part by Morgan's work in Philadelphia, matured in 1783 under the prodding of John Warren.

The establishment of schools in America did not have the effect of lessening the desire for additional medical training abroad. Before professional schools existed in the colonies it was customary to get medical training by association with some distinguished physician, who himself had probably been abroad. The young doctor, if he wished for distinction in his profession, then made every effort to attend courses of lectures in Europe, or visit the hospitals in the capitals on the continent and in England, to observe at first hand the finest technique of the day. It was exceedingly fortunate that

[10] M. Kraus, *Intercolonial Aspects of Amer. Culture on the Eve of the Revolution*, Chap. VII.

[11] Packard, I, pp. 306, 319.

so many students went to Edinburgh, probably the best school of its day, founded as it was by the pupils of Boerhaave. In Edinburgh they were instructed in the principles prescribed by Boerhaave. They carried home to America the Dutch master's books, " applied his principles in their practice and passed them on to their apprentices." Boerhaave's ideas in medicine were dominant in America till near the close of the century.[12] It is surprising to note the considerable number of Americans who attended medical lectures in Paris, Leyden and other Continental centers. After the Revolution many Americans went to France to study. Many Americans went overseas to complete their medical training without taking degrees in any of the universities, but these too, contributed an important share to the improvement of American medicine. Although the records are incomplete, it is fairly certain that few doctors after 1760 achieved distinction without some instruction in Europe. From the most important center in America, Philadelphia, students carried the ideas of Benjamin Rush through the length and breadth of the United States.[13] Americans soon began to write home that medicine was " taught more scientifically in Philadelphia than in London." It was complained, too, that teachers in England were not as attentive to the needs of their pupils.[14]

It was not American attendance at European medical centers alone that enhanced the prestige of American medicine, it was also the migration of European doctors to the colonies. Dr. Alexander Garden, Lionel Chalmers and Cadwalader Colden were a few of those who brought medical knowledge and often a general intellectual distinction to colonial groups with whom they made their homes.

While America was largely a debtor to Europe for education in medicine the balance was partly redressed by the free exchange between them of proposals for the advance of medical science. In the initial issue of a London medical journal it was pointed out that valuable information could be secured from the colonies, " where

[12] Sigerist, " Boerhaave's Influence upon American Medicine," *loc. cit.*, p. 4.
[13] Nathaniel Goodman, *Benjamin Rush*, p. 128.
[14] W. S. Ruschenberger, *An Account . . . of the College of Physicians of Philadelphia* (Phila., 1887), p. 17.

there are physicians of great experience and abilities." [15] Years before this publication urged transatlantic medical correspondence, Dr. John Lining of Charleston, S. C., forwarded the results of observations and experiments he had been making to find the causes of epidemic diseases which returned regularly with the seasons.[16]

Many of the individuals who were physicians by profession were very much interested in natural science and they were appreciative of the contributions which allied scientists could make to the art of healing. Dr. John Fothergill questioned John Bartram about the medicinal plants "in use among [American] practitioners; or even celebrated among the vulgar." [17] Bartram replied that there were very many roots, herbs and barks used in America, which were discovered by the Indians. He remarked that inexpert use of them made people discard them when seemingly ineffective.[18] A half century earlier, Dr. Nehemiah Grew, a pioneer in the study of sex in plants, conducted a correspondence with Americans in Rhode Island and Virginia which indicated an active interest in medical practice among the Indians.[19] One of the better known American contributions was the snake root which was regularly exported from Virginia. Bernard de Jussieu, Royal Professor of Botany at Paris, told Dr. Bond that the root had been "sent him with a recommendation and method of use in pleurisies and repeatedly tried with surprising success [so that it] was in the highest esteem with him and many other physicians." William Byrd likewise spoke highly of the rattlesnake root, a considerable quantity of which his friend Dr. John Tennent was taking over to Europe for experimental purposes.[20] The Edinburgh medical fraternity were soon to become

[15] *Medical Observations and Inquiries*, by a Society of Physicians in London, 1757, vol. I., preface v-vi. Dr. John Fothergill was very active in behalf of this publication, F. R. Packard, *History of Medicine in the U. S.* (N. Y., 1931), vol. 2, p. 1121, note 1.

[16] Royal Society Library, mss., "Letters and Papers," Decade I, 188, April 11, 1741, Jan. 22, 1740/41; I, 374 (Jan. 29, 1743); see also *Trans. Royal Society* (London), vol. 42 (1742-43), pp. 491-510.

[17] William Darlington, *Memorials of John Bartram and Humphry Marshall*, March 22, 1743-44.

[18] *Ibid.*, July 24, 1744.

[19] *Col. Soc. Mass., Trans.*, XIV, 145.

[20] *Sloane Mss.*, May 31, 1737, add. mss. 4055 f., 112.

familiar with Tennent's work on the snake root.[21] His pioneer studies familiarized British and French physicians with snake root which was later cultivated in Europe.[22] Gov. William Gooch of Virginia sent to London a specific which was supposed to cure venereal diseases. Next to the service to be expected from it, wrote the Governor, " I wish it may be an encouragement to one of the travelling Phisitians to take a Tour into America, where he'll profit much more than by a jaunt to France & Italy.[23] William Byrd urged Dr. Hans Sloane to endow traveling fellowships for English doctors to familiarize themselves with valuable plants. It was the noted traveler-scientist Peter Kalm who brought to the attention of his master, Linnaeus, a reputed Indian cure for venereal disease.[24] It may have been the sarsaparilla root that Gov. Gooch had sent over. At any rate some years later a military surgeon, William Fordyce, was experimenting with this root and he confirmed the optimistic claims that had been made for it.[25]

The publications of the period and the correspondence of physicians often refer to medicinal plants introduced into Europe from America. On the other hand, it must not be forgotten that most of the drugs used by American doctors in their practise generally came from London. Such doctors as Sylvester Gardiner of Rhode Island, and Dr. Simeon Smith of Connecticut, kept large stocks of drugs imported from England and the Continent which they then dis-

[21] *Medical Essays and Observations*, by a Society in Edinburgh, vol. V, 1744, part II, 906, 1006; Tennent, *An Epistle to Dr. Richard Mead, concerning the epidemical Diseases of Virginia . . . wherin is shown the surprising efficacy of the Seneca Rattle-Snake Root* (Edinburgh, 1738), particularly pp. 97-98 giving cases.

[22] William Woodville, *Medical Botany containing . . . the medicinal plants . . . in the catalogues of the Materia Medica [of] the Royal Colleges of Physicians of London and Edinburgh . . . [and] their medicinal effects* (London, 1790-1793, 3 vols.), II, 253-255; *Mémoires de l'Académie Royale des Sciences*, 1739, pp. 135, 139; *Ibid.*, 1744, p. 37 et seq.

[23] *Virginia Mag. of Hist. and Biog.*, vol. 32, p. 229, June 29, 1729; There are a number of references in 18th cent. correspondence of Indian remedies for venereal diseases, e. g., *Gent., Mag.*, vol. 27, pp. 405-406.

[24] *Sloane Mss.*, 4055 f., 112, May 31, 1737 (Brit. Mus.); Sir James E. Smith, *A Selection of the Corr. of Linnaeus and other naturalists* (London, 1821), Dr. Jussieu to Linnaeus, Feb. 19, 1751.

[25] *Medical Observations and Inquiries*, by a Society of Physicians in London, vol. I, 1757, art. xvii, p. 149.

tributed to other American communities.[26] Dr. Rush urged British doctors to send their tubercular patients to America whose climate was more likely to effect a cure.[27]

Publications on both sides of the Atlantic frequently included correspondence exchanged between practitioners.[28] A Scots periodical drew the attention of its readers to the " famous American Receipt for the Rheumatism." [29] " An Essay on Fevers " by Dr. Lionel Chalmers of South Carolina, was drawn upon shortly by an English doctor who strongly endorsed Chalmers' proposals for purging and sweating " as the most effectual means of stopping the progress of fevers.[30] An American doctor observed that his countrymen had long been borrower from Europe. " As the terms granted us have been liberal and advantageous, it is time for us," he said, " to think of reimbursing the loan." And with a certain pride he stated that Americans were prepared to cancel, in part, their " weighty obligations." It was claimed, for example, that febrile diseases were better understood in America than elsewhere.[31] Certainly no one aided more than did Benjamin Rush in canceling those obligations. " His opinions may not always be the most maturely weighed," said a London reviewer, " but he is by no means a dull nor a commonplace author. He has often added new facts to the general stock of knowledge, and his readers must be morose, if they be not entertained by his ingenuity." [32]

The thought of utilizing electricity in healing human ills occurred to a considerable number of doctors. A magazine item of 1749 told of a German professor's experiments in applying electricity in his medical practice.[33] At an early date Franklin and Dr. Cadwala-

[26] Thacher, *American Medical Biography*; H. E. Smith, *Colonial Days and Ways*, p. 333.

[27] *Lettsom Memoirs*, vol. III, p. 191, June 15, 1790.

[28] E. g., *Medical and Philosophical Commentaries*, by a Society in Edinburgh (6 vols.).

[29] *The Weekly Magazine, or Edinburgh Amusement*, vol. V (1769), p. 210.

[30] Anonymous. *Reflections on the General Treatment and Cure of Fevers* (London, 1772), p. 49 (in library of Royal Soc. of Medicine).

[31] Charles Caldwell (ed.), *Medical theses, selected from among the Inaugural Dissertations of the Univ. of Penn.* (Phila., 1905), p. ix.

[32] *The Monthly Review, or Literary Journal*, enlarged series, vol. 19 (1796), p. 413.

[33] *Gentleman's Magazine*, vol. 19, pp. 452-453.

der Evans had used electric shocks in an attempted cure and they communicated their experiment to the physicians of London.[34] Dr. Robert Whytt and Dr. John Pringle, both of whom kept in close touch with American medical progress, discussed the use of electricity in the cure of a palsy. Franklin had sent some observations on the effects of electricity in paralytic cases to Pringle, noting that the improvement appeared temporary. He suggested that more permanent benefits might be achieved if the electric shocks were accompanied by proper medicine and regimen.[35] Pringle on one occasion asked Franklin to assist him in treating a patient with electricity.[36] John Wesley was an enthusiastic believer in the use of electricity in curing ailments and he claimed to have treated hundreds of patients. Priestley had high regard for Wesley's electrotherapeutic measures.[37]

Within a period of twenty years a number of doctors had apparently come to use the electrical machine as aids in a number of cases.[38] Specialists had arisen claiming especial skill in the construction of electrical machines used in medicine and it was stated that many improvements had been made in applying electricity.[39] Another advantage claimed for it was that it would be useful in resuscitating persons rescued from drowning.[40] Dr. Perkins, inventor of metallic tractors, gave his name to a cult, Perkinism, which created a furore in Europe and America at the turn of the century. Doctors and lay individuals experimented and discussed the theories of Perkins and while the conclusion was that medicine had little to gain from Perkinism, the study of physiology might be aided.[41]

[34] *Medical Observations and Inquiries*, by a Society of Physicians in London (1757), vol. I, p. 83.

[35] *The Works of Robert Whytt.* Published by his son. (Edinburgh, 1768), pp. 483-487. Smyth, *Franklin's Writings*, III, Dec. 21, 1757.

[36] *Cal. of Franklin Papers*, II, 1758?

[37] E. M. North, *Early Methodist Philanthropy*, pp. 44-45; H. A. Colwell, *An Essay on the History of Electrotherapy and Diagnosis* (1922), p. 24.

[38] *Med. Obs. and Inquiries* (London, 1776), vol. V, art. 1.

[39] See advt. of G. Adams in W. Cadogan, *An Essay upon Nursing* (1772); John Birch, *Considerations on the Efficacy of Electricity in removing Female Obstructions.* To which is now added a Description of the Manner of Applying it (London, 1780, 2nd edn.), p. iv. note.

[40] Rev. Samuel Glasse, *A Sermon in Favour of the Humane Society* (London, 1793), p. 45.

[41] *Tilloch's Philosophical Mag.*, vol. II, p. 188; Colwell, *op. cit.*, p. 47.

Political differences between England and the colonies had no important effect on the friendly relations that existed between doctors on both sides of the Atlantic. Younger men, like Dr. Samuel L. Mitchill of New York were in frequent correspondence with European practitioners. Collaboration between them was, if anything, closer after the Revolution than before. In the pages of *The London Medical Journal* beginning with the first volume in 1781 are to be found many signs of this interactivity. Studies of hydrophobia were underscored by inclusion of American knowledge sent from New York and Philadelphia.[42] There were a great many cases of this dreaded disease in the United States in the 1780's.[43] James Mease's "Dissertation on the Disease produced by the Bite of a Mad Dog" (Phila., 1792) was considered of sufficient importance to be republished in London the next year sponsored by Dr. Lettsom. This London reprint partook of the character of a symposium on hydrophobia and tetanus, containing as it did opinions of English and American doctors which each had communicated to the other. The contribution of Dr. Lionel Chalmers of Charleston, on tetanus, was adjudged superior to that of any contemporary.[44]

The observations of American army doctors were communicated to English colleagues and articles appearing in American scientific publications were reprinted in England.[45] In a review of "The Medical Repository of New York" which had been sent over by Dr. Mitchill, a London medical journal lamented the limited intercourse with the western world but hoped now that this publication would keep England in touch with American medicine.[46] Very proudly Ezra Stiles sent to Edinburgh copies of the earliest published memoirs of the New Haven Medical Society.[47] The medical school in Philadelphia, following the trend of scientists to write in the vernacular, apparently inaugurated the practice of permitting theses to

[42] *London Med. Journal*, vol. V, pp. 286-289; vol. X, letter of Thomas Percival to Dr. Haygarth.

[43] Packard I, p. 103.

[44] *Encyclopedia Britannica* (3rd edn., 1797), art., "medicine," p. 253.

[45] *London Med. Journal*, vol. 7, pp. 294-297, 291-305, 424-434.

[46] *The London Med. Rev. and Mag.*, vol. VI, pp. 133-134.

[47] Stiles, *Diary*, Aug. 30, 1788.

be written in English, a fact that caught the attention of a London journal.[48]

From England, France and Germany came inquiries to Franklin asking him for the details of a cure for dropsy mistakenly attributed to him.[49] Franklin's knowledge was valuable to Dr. Thomas Percival of Manchester in studying the correlation between smoke and the increase in pulmonary complaints. Franklin participated in a fresh air campaign for the sick and for the healthy. He wrote to a French doctor that physicians "have begun to discover that fresh air is good for People in the Smallpox, and other fevers." He hoped they would in time, find out "that it does no harm to People in health." [50]

American doctors were rather favorably known in France, partly as a result of Franklin's good offices. The Royal Society of Medicine in recognition of the especial achievements of some American doctors conferred upon them the title of correspondent. The publications of the Royal Society included papers written by American physicians.[51]

In the establishment of hospitals Americans naturally followed European models. Franklin sent news of the founding of the Pennsylvania Hospital to Sir Alexander Dick (president of the College of Physicians at Edinburgh) believing the Scotsman would be delighted to know that Americans had "imitated the Edinburgh Institution of an Infirmary." For the benefit of the hospital Franklin visited several British institutions and sent back to Philadelphia their rules of procedure.[52] David Barclay and John Fothergill generously assisted in financing the Pennsylvania hospital and sent over books for its medical library. In equipping the hospital Fothergill suggested the use of iron bedsteads.[53] When the "Society of the Hospital in the City of New York" was established in 1771, Dr.

[48] *Medical Facts and Observations*, vol. I (1791), p. 204 footnote.

[49] *Cal. of Franklin Papers*, II, Feb. 1, 1777, Nov. 21, 1777, May 20, 1778; Smyth, *Franklin's Writings*, I, pp. 118-119.

[50] Smyth, vol. I, pp. 61-62; June 22, 1773, to J. B. Le Roy.

[51] *Cal. of Franklin Papers*, II, Sept. 7, 1780; II, Aug. 31, 1779.

[52] Smyth, Jan. 3, 1760, Feb. 26, 1761.

[53] A. M. Gummere in *Friends Hist. Soc. Bull.*, vol. I, no. 1, pp. 20-21. Packard, I, p. 220-221.

Fothergill was one of the incorporators. Through the joint efforts of himself and Sir William Duncan money was raised for the institution in London.[54] The founding of the Philadelphia Dispensary to administer to the poor followed directly upon the suggestion of Dr. Henry Moyes, the energetic organizer of Humane Societies in various parts of the world.[55]

A very profitable result of the scientific relations between the colonies and England was the mutual encouragement each offered to the other in the adoption of inoculation against smallpox. Although Cotton Mather, who was responsible for its adoption in America, is supposed to have learned about it from an article in the Royal Society's Transactions, it is clear that he knew the value of this practise from a slave who testified that it had long been in use in Africa. With that crusading spirit so typically his, Mather wrote to Dr. John Woodward of the Royal Society: "How does it come to pass, that no more is done to bring this operation, into experiment & into Fashion in England? . . . I beseech you, Syr to move and save more Lives than Dr. Sydenham. For my own part, if I should live to see the Small-Pox again enter into our city, I would immediately procure a consult of our Physicians, to Introduce a Practice, which may be of so very happy a Tendency, But could we hear, that you have done it before us, how much would that embolden us!" [56] Five years after this letter was written, in the presence of an epidemic, Mather carried out his part by urging the adoption of inoculation on the physicians of Boston, all of whom were opposed with the exception of Zabdiel Boylston. Mather was writing shortly that the success of inoculation in Boston was such that "we need nothing from the other side of the Atlantic to embolden our proceeding." [57]

To his diary, Mather confided the hope that his writings on this subject, addressed to an audience in England where they were published would make her adopt the practise. Mather's hope was to

[54] Packard, I, p. 233.

[55] Ruschenberger, *An Account of . . . the College of Physicians of Phila.*, pp. 124-125.

[56] G. L. Kittredge, "Lost Works of Cotton Mather," *Mass. Hist. Soc., Proc.*, 54, letter of July 12, 1716.

[57] Royal Soc. Library, mss. "Inoculation Letters and Papers," Mather to Dr. Jurin, May 21, 1723, p. 48.

some extent realized. Sir Hans Sloane, to whom one of these writings was dedicated, was much interested in inoculation. English writers quoted Mather, and Dr. James Jurin, Secretary of the Royal Society, who also wrote on this subject, kept in close touch with developments in New England. At the same time London papers were presenting to a larger public news of the Boston epidemic and the experiments in inoculation.

The use of this medical practise was far more quickly adopted in the colonies, however, than in Europe. After a few years of considerable progress the practice seems to have fallen into disuse in England. Twenty years after Mather's correspondence with London physicians, Peter Collinson wrote Bartram: "I hear [that smallpox inoculation] is very successfully operated with you—but obtains little with us." [58] However just at about the time Collinson was writing in so discouraged a tone to Bartram, the favorable accounts that kept coming from America inspired a revival of interest in Great Britain. The establishment of an Inoculation Hospital in London helped to gradually break down resistance to the novel medical practice.[59] Not until the second half of the century when prominent doctors like John Fothergill became its protagonists was this practice generally adopted. The London Medical Society was strongly in favor of inoculation; the objections to it were thought so trivial as to be unworthy of notice.[60]

The whole conflict over the adoption of inoculation against smallpox was fought along parallel lines in England and America. The same opposition on religious grounds had to be overcome in both countries and the Rev. Dr. Cotton Mather punctured the arguments of those who enlisted God in their behalf. "It is *cavilled* . . . that this *New Way* comes to us from the *Heathen*, and we *Christians* must not *Learn* the *Way* of the *Heathen*." Mather then asks if Hippocrates were not a heathen? "And whether we have not learnt some of our very Good Medicines from our Indians? . . . And,

[58] Darlington, Feb. 3, 1741-42.

[59] William Woodville, *The History of the Inoculation of the Small-Pox in Great Britain* . . . (London, 1796).

[60] *Medical Observations and Inquiries*, 1767, vol. III, pref. vi-vii.

Gentlemen Smokers, I pray, whom did you learn to Smoke of?"[61] In England one champion derided the injunction to trust in Providence alone. Providence, he replied, "Has given us Heads and Hands to contrive and execute what is most for our advantage. . . . To trust in Providence is to do all we can for ourselves, and then to believe we shall be taken care of."[62] The *Gentleman's Magazine* observing the obstacles put in the way of the adoption of inoculation suggested that Englishmen turn their eyes to New England "and see what success it has there found and whether the mother may not be instructed by the daughter."[63]

There was a constant interchange on the subject of inoculation and the improved methods in its practice. One of those credited with reviving its use in England was a Dr. J. Kirkpatrick who had practised in America and had returned to London where he published a pamphlet on the success of inoculation in South Carolina. Dr. Kirkpatrick had apparently won a distinguished reputation for he was chosen to inoculate some of the highest of the French nobility.[64] The use of mercury as a preparative for inoculation was known to Americans in the 1740's (employed by Dr. Thomas of Virginia and Dr. Muirson of Long Island) and was communicated to English doctors by Dr. Benjamin Gale of Connecticut.[65] Dr. Gale had sent his pamphlet on inoculation to a Dr. Andrew of Exeter, and in it he had pointed out that before the use of mercury and antimony in preparing people for inoculation one out of 100 of the inoculated died, whereas with their use the mortality rate was only one in 800.[66]

[61] *Some Account of what is said of Inoculating or Transplanting the Small Pox* by the learned Dr. Emanuel Timonius and Jacobus Pylarinus . . . (pub. by Zabdiel Boylston, Boston, 1721, but Mather's work). See also Royal Soc. Lib. mss. "Inoculation Letters and Papers," Mather to Dr. Jurin, May 21, 1723, pp. 38-40.

[62] David Hartley, *Reasons why the Practice of Inoculation ought to be introduced into the Town of Bury at Present* (1733), p. 18.

[63] 1753, vol. 23, p. 414.

[64] J. Kirkpatrick, *The Analysis of Inoculation* . . . (London, 1754), pp. 110-111, and Woodville, *op. cit.*, 306.

[65] Muirson told Ezra Stiles he had gotten the hint from Boerhaave; Stiles *Diary*, June 17, 1784; Packard, I, 501.

[66] Woodville, *op. cit.*, 339-343, . . . See Benj. Gale, "Historical Memoirs relating to the Practise of Inoculation in New England" (1765) in *Roy. Soc. Lib. Mss., Letters and Papers*, IV, 261, Sent to Dr. Huxham.

To advance the cause Benjamin Franklin wrote a propaganda pamphlet for the use of Dr. William Heberden of London in 1759 which drew upon American experience. Swedish doctors were soon familiar with the practise of Philadelphia physicians who used mercury in conjunction with antimony.[67]

The victory of the proponents of inoculation elsewhere in Europe was made easier by the example set by Americans. It is supposed that Dutch physicians gained in confidence after the publication of Dr. J. V. B. Tennent's thesis on his graduation from Leyden. In his "Dissertatio . . . de Insitione Variolarum" (1764) Dr. Tennent, who had come from New Jersey, spoke of the new methods used in inoculation and he included a table of inoculations performed in several of the colonies. He observed that out of over eight thousand inoculated, only nineteen died.[68] Wherever the fight went on Americans participated or their experience was drawn upon and while sometimes the verdict was hostile, in the main the reactions were favorable. What is perhaps the first notice in France of inoculation quoted its good effects in Boston.[69] M. De La Condamine in a memoir read to the Royal Academy of Sciences in France urged the adoption of inoculation. A few years later Dr. M. Gatti in a tract published in Brussels gave a strong endorsement to inoculation. Dr. Thomas Bond in a pamphlet published in Strasbourg, showed a close acquaintance with the progress of this medical practice in England, France and America, and he noted especially the similarities of English and American methods.[70] A Society for General Inoculation was established in London which was hailed by Dr. Lettsom as

[67] John A. Murray, *Historia Insitiones Variolarum in Suecia . . .*" (Gottingae, 1767), pp. 156-157 referring to a Stockholm publication by Nils Rosen von Rosenstein (1764).

[68] See p. 39 of the "Dissertatio."

[69] M. De La Coste, *Lettre sur l'Inoculation de la petite vérole . . .* (Paris, 1723), pp. 36-37.

[70] M. De La Condamine, *Memoire sur l'Inoculation de la petite vérole* (Paris, 1754); *Nouvelles Réflexions sur la pratique de l'Inoculation* par M. Gatti (Brussels, 1767); Thomas Bond, *Défense de l'Inoculation et Relation des Progrès qu'elle a faits a Philadelphie en 1758* (Strasbourg, 1784); *Recueil de Pièces concernant l'Inoculation de la petite Vérole, & propres a en prouver la sécurité & l'utilité* (Paris, 1756), p. 43 et seq.

contributing greatly to popularizing this medical practice.[71] Facilities for inoculating the poor were established in a number of the provincial towns of England after London had given the lead.[72]

Dr. Benjamin Waterhouse engaged in a correspondence with Dr. John Haygarth on the subject of smallpox in which he gave a number of details of treatment used in preventing its spread. Waterhouse, who felt that Americans knew more about the disease than Europeans, said that the practice in his country and particularly in New England, was to have nearly every one inoculated. Haygarth who was engaged in the movement for the adoption of inoculation, informed others in Europe of the contents of the correspondence of Waterhouse. For example, in writing to the Council of Health in Geneva, Haygarth said, "The letters of Professor Waterhouse exhibit an excellent picture of a country, where the casual small-pox is justly dreaded and inoculation eagerly sought by soldiers, sailors and every other class of people."[73]

Waterhouse is, of course, better remembered for his work in behalf of vaccination as a more efficient preventive against smallpox. It was that good angel of Americans, Dr. Lettsom, who sent Waterhouse, in 1799, Edward Jenner's "Inquiry into the causes and effects of the . . . Cow Pox." On reading this work, said Waterhouse, he "was struck with the unspeakable advantages that might accrue to this country, and indeed to the human race at large, from the discovery of a mild distemper that would ever after secure the constitution from that terrible scourge, the small-pox." He then drew up an account of cow-pox which was printed in an American newspaper.[74] Waterhouse embarked on a campaign of public education in which he used information collected from various English

[71] *A Letter to Sir Robert Barker and George Stacpoole, upon General Inoculation*, J. C. Lettsom (London, 1778).

[72] *An address to the Inhabitants of Liverpool on the subject of a General Inoculation for Small Pox* (Liverpool, Sept. 1, 1781), pp. 3-4 (Brit. Mus., T 35).

[73] John Haygarth, *A Sketch of a plan to exterminate the casual Small-Pox from Great Britain . . . to which is added a correspondence . . .* (2 vols. in one, London, 1793, pp. 259-364, 516, 562).

[74] *The Columbian Centinel*, March 12, 1799; Waterhouse had known Jenner in England, "Extracts from the Journal of Benjamin Waterhouse" in *Cambridge Hist. Soc., Publica.* IV, p. 24.

physicians. He sent to England for some of the vaccine (which Dr. Haygarth sent him) and inoculated his children with it. The people of New England, he said, had "set a noble example to their older brethren of Old-England, in adopting . . . inoculation for small pox, in 1721. Now, the English, in their turn, lead the way in a practice still more salutiferous," and Americans were urged to adopt it.[75] Waterhouse, called "the American Jenner," was largely responsible for spreading a knowledge of vaccination through the states, sending vaccine to doctors in Philadelphia, New York, Charleston, and Virginia. A fellow Bostonian, Dr. James Jackson, was also active in familiarizing Americans with the new medical treatment. In Baltimore Dr. John Crawford, a founder of the local dispensary, was hardly behind Waterhouse in the practice of vaccination.[76] Doctors in New York formed a Vaccine Institution patterned after the one in London. By his English contemporaries Waterhouse was classed with Jenner, John Ring and others in effecting the adoption of vaccination, and Jenner himself valued highly the judgment of the American doctor.[77] The problem of eradicating smallpox, first by inoculation and then by vaccination, was the central one in transatlantic medical communications. The success that attended this American-European cooperative attack on one of humanity's worst scourges was a promise of greater victories to come in the war against disease.

[75] Benjamin Waterhouse, *A Prospect of Exterminating the Small-Pox; being the History of the Variolae Vaccinae or Kine-pox* . . . (Boston, 1800); John Ring, *A Treatise on the Cow-Pox; containing the History of Vaccine Inoculation* . . . (London, 1801), p. 458.

[76] Packard, vol. I, p. 437, vol. II, p. 978.

[77] Waterhouse, *A Prospect of exterminating the Small Pox* (Cambridge, Mass., 1802), part II; this was inscribed to Lettsom and Jenner; Lettsom, *Hints designed to promote Beneficience, Temperance and Medical Science* (1801), vol. 3, pp. 25, 66.

A HISTORY OF THE CLASSIFICATION OF HUMAN BLOOD CORPUSCLES *

(PART I)

JEAN CAPTAIN SABINE **

From the earliest times the blood has been recognized as a vital substance, physiologically active and essential to life. Early medical writings abound in comments and theorizings on its nature and functions. The Hippocratic writers devoted considerable space to discussion of its physiology. Martine believed that they inferred particles in the blood in their use of the words "haema" and "phlegma." I do not believe, however, that it is possible to place such an interpretation on the Greek passages to which Martine refers, in which the writer refers to the "haema" as strictly separate from the "phlegma," and says that a mixture of the two is harmful: "*καὶ οὔτε τὸ φλέγμα οὐδὲν ἐοικέναι τῷ αἵματι, οὔτε τὸ αἷμα τῇ χολῇ. . . .*" (and neither does the 'phlegma' in any way resemble the 'haema,' nor the 'haema' the bile) (*πέρι φύσιος ἀνθρώπου*: p. 21). "*ταῦτα δὲ πάσχει πάντα, ὁπόταν τὸ φλέγμα παραρρυῇ ψυχρὸν ἐς τὸ αἷμα θέρμον ἐόν. . . .*" (and he (the patient) suffers all these (symptoms), whenever the 'phlegma' which is cold flows into the 'haema' which is hot) (*πέρι ἱερῆς νούσου*: p. 125). "Haema" is used throughout to designate the red fluid blood as it flows from a wound, and there is no indication that the Hippocratic writer regarded it as consisting of separable components.

In the writings throughout the premicroscopic period are constant evidences that the study of the blood was very general. There are notes on its chemical composition, its physical properties, and its behavior under all kinds of experimental conditions and treatment. The discovery of its corpuscles was a very natural result of the

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development of the microscope. Highmore, in 1651, introducing a chapter on the blood, says that because of the diversity of its functions the blood must of necessity consist of heterogeneous elements: "Partes itaque quae omnimodo sunt heterogeneae, ex diversis constructae particulis, iisdem nutrire, exquibus immediate constant, est necesse; quia ad nutritionem et conservationem unio particularum necessario requiritur; at in dissimilibus et asymbolicis unionem et concordiam expectare non possumus, idioque nec assimilationem et nutritionem. Sanguis itaque ut hisce dissimilaribus partibus alimentum praebat, ex particulis heterogeneis conflari oportet." (Thus it is necessary to nourish parts which are entirely heterogeneous, constructed of different particles of which they naturally consist; for this nutrition and conservation a unity of particles is of necessity required; but we cannot expect harmony and agreement among dissimilar and asymmetrical things, and so neither assimilation nor nutrition. In order that it may nourish all these dissimilar parts, the blood must consist of heterogeneous particles.) (p. 190)

The Discovery of the Erythrocyte and perhaps of the Leukocyte

The first step in the story of the classification of these "particulae heterogeneae" was of necessity the observation and description of them, the actual proof of the existence of particles in the blood. The absolute priority is difficult to evaluate because of delays in publishing. There is little doubt, however, that Swammerdam was the first to see the blood corpuscles.

A physician by training but a natural scientist by inclination, Swammerdam leaves his *Biblia Naturae* as his best known work. In this he dealt minutely with the anatomy of various small animals, and in a section on the circulation in the adult frog, he described the red corpuscles of the frog's blood: "In sanguine serum conspiciebam, in quo immensus fluctuabat orbicularum particularum ex plano veluti ovata, penitus tamen regulari, figura gaudentium, numerus. Videbantur autem hae ipsae particulae alium insuper humorem intra se continere. Quodsi a latere contuebar; crystallinos quasi bacillos, pluresque alias figuras similabant; prout nimirum diversimode in sero sanguinis circumvolvebantur." (In the blood I observed the

serum, in which floated an enormous number of orbicular particles, rejoicing in a very regular shape, seen as an oval when viewed broadside. Moreover these particles themselves are seen to contain another humor within themselves. And if I looked upon them from the side, they almost resembled crystalline rods, and a variety of figures; and no doubt in the same way they are rolled around in the serum of the blood.) (t. ii: 835) This is an amazingly good description, and would be remarkable even if it had not the distinction of being the earliest. Most authorities give 1658 as the date of this writing, although it was not published until after Swammerdam's death, when his friend Boerhaave had it published in 1737. Swammerdam did not describe the human red corpuscle, but speaks of it casually as of an established fact. (t. ii: 69) In his *Tractatus de Respiratione* (1667) Swammerdam spoke of the way in which the "particulae sanguinis" are churned about and forced to collide with one another in the pulmonary circulation. Though of an earlier publication date, this is obviously a subsequent writing to that quoted above. Thus Swammerdam undoubtedly knew of the red corpuscles of the frog and of the human, left a description of the frog's red corpuscles unquestionably dating from 1658, and a published reference to them in 1667.

In 1661,[1] three years after the earliest date for Swammerdam, the gentle, scholarly Malpighi saw the red cells circulating in the mesentery of the frog: "In omento histricis, in sanguineo vase, . . . globulos pinguedinis propria figura terminatos vidi rubescentes, et corallorum rubeorum vulgo coronam aemulabantur." (In the mesentery of the uterus, in the blood vessels, I have seen ruddy globules of fat of very uniform shape, and resembling an ordinary necklace of red coral.) (*Opera Omnia*, t. ii: 235-6) "In venis autem minimis decolor est, et in eo videntur interpositi orbiculi diaphani, et quasi sublutei, dum luce irradiantur . . . sanguis in arteriis minimis parum rubescit, et mixtos habet globulos, quasi subluteos, in quibus non vidi motum rotationis." (In the smallest veins it is colorless, and scattered in it are seen diaphanous small spheres, almost yellow,

[1] Reference here is to *Opera Omnia* 1687. Authority for the earlier publication of this paper as a monograph in 1661, entitled *Exercitio de Omento, Pinguedine, et adiposis ductibus*, is Milne-Edwards (t. i: 41 ftn.).

when they are illuminated . . . the blood in the smallest arteries appears slightly red, and has globules mixed in it, almost yellow, in which I did not see any rotary movement.) (Posthum.: 123) Also in his classical description of the lung, *De Pulmonibus*, Malpighi described the blood corpuscles as they circulate. There is a possibility that Malpighi saw the white corpuscles as well as the red. Von Haller believed this to be true and referred to the passage last quoted as indicating that this is so. Whether Malpighi's " particulae subluteae " are actually white corpuscles seems somewhat doubtful. We may, however, at least be certain that Malpighi saw and described the red blood corpuscles, and has left what is probably the earliest published record of them.

A few years later the red corpuscles were independently seen and described by the ingenious Dutch upholsterer Leeuwenhoek, working with his crude simple microscopes with home-ground lenses in the back room of his shop. Most of his work was sent in letters to the Royal Society, translated and published in *Philosophical Transactions*. His earliest description is in 1674: " I have divers times endeavoured to see and to know, what parts the Blood consists of; and at length I have observ'd, taking some Blood out of my own hand, that it consists of small round globuls driven thru a Crystalline humidity or water: Yet whether all Blood be such, I doubt. And exhibiting my Blood to my self in very small parcels, the globuls yielded very little colour." (p. 23) Leeuwenhoek may also have seen the white corpuscles: " . . . the clearer aqueous matter of the Blood being that Liquor in which the red sanguineous globuls swim, doth likewise consist of globuls; and that I had observed such in that aqueous matter, when the moisture was somewhat, or for the most part exhaled. But I cannot now omit to acquaint you, that a few daies after I had sent away that Letter, I saw the plain globuls move in the waterish matter without any evaporation made; though there were but very few of them, and they appeared white where they lay together." (1675: 380) It must be remembered that these publications are not the actual words of Leeuwenhoek, for it is well known that he knew no language but Dutch.[2] Many shades of meaning in any author's original message may be hidden by the dark glass of

[2] Dobell: 1, 4.

translation, and evaluation based on wording and terminology is difficult. However, these writings of Leeuwenhoek are so direct and unadorned that we may be pretty sure that Leeuwenhoek is not being obscured. In 1700 he described the circulation of blood corpuscles in the tail of the living frog tadpole much as Malpighi had done. He tells of a large vessel in which twenty red corpuscles could run together at a time, and of vessels so small that only a single particle could pass at once, often so slowly that the flow appeared to be arrested, and in the smallest vessels he could see each impulse that the blood received from the heart.

Other Early Descriptions of the Red and White Corpuscles

In a very dull treatise of the textbook type written in 1686, Bohn described the blood as having " sphaerulae " and " globuli " floating in the serum. He made no implication that this was an original observation, and we may infer that the existence of at least red blood corpuscles was pretty well recognized at this time, from the fact that it is included in a work of this kind.

Cowper (1702) saw and described the capillary circulation in the omentum of a cat and of a dog, and also in the web of a frog, the tail of a tadpole and in a young fish. He did not, apparently, see the white corpuscles.

Throughout the eighteenth century a great deal of work was done on the blood and many and sometimes conflicting observations were made. The serum and cruor were analyzed and subjected to all kinds of physical and chemical tests. Leeuwenhoek described a breaking up of the red blood corpuscles into six smaller ones each of which was capable of redivision into six more. Various observers carried out this idea enthusiastically, some claiming that the process went on ad infinitum. The lines of thinking and the vigor with which the new field was attacked are satirically reflected in the following excerpt from a contemporary essay by Martine (1737): " What an odd work did Mr. Descartes and his mathematical Disciples make in the animal Machine? The Particles of his several Elements served them upon all Occasions; and you would think they had actually seen the different Spheres, Cubes, Prisms, Pyramids, Parallelopipeds,

etc., circulating in the Mass of the Blood, and wisely adapting themselves to all the Purposes they were pleased to appoint them . . . upon a nearer View and the strictest Scrutiny . . . all we can discern, when assisted by the best of Microscopes, are spherical Particles swimming in a pellucid Liquor." (t. ii: p. 72)

Out of all this came several observations of significance. The elasticity of the capillaries was noted by Leeuwenhoek (1700), and by Cowper (1702). The flatness of the globules was described, as we have already noted, by Swammerdam; it was seen again by Senac (1749),[8] by Hewson (1770), and by di Torre (1776). Senac remarks that the corpuscles must be "comme des corps solides et impénétrables" or else they would run together. (p. 278) The dark or light spot was seen by Senac, di Torre and Hewson.

Apparently a large number of people had mentioned the white corpuscles by the middle of the century. Von Haller gives many references to writers who speak of them. Lancisi (1740) apparently saw them. In an account of microscopic examination of the blood he described, in addition to "innumeros globulos rubro colore tinctos," "globuli non ovali figura" which occurred in fewer numbers and had no red color.

Boerhaave (1743) certainly regarded the blood as containing several varieties of corpuscles. ". . . it is necessary for the Blood to contain a sufficient Number of the Globules of all Sizes, as well of the larger red, and serous ones, as of many smaller and pellucid lymphatic ones, that every series of Vessels may receive their adequate Globules." (t. ii: 125) This again is only a translation of the Dutch, but the terms are very clear. This is the first use of the word "lymphatic" in connection with the white corpuscles which I have found. It probably does not imply a relationship with the lymphatics, however, as Boerhaave regarded the white blood corpuscles as derivatives of the red, and I have found no evidence that he connected the white cells with the lymphatic circulation or with the cells of pus.

Von Haller (1756) described large, transparent globules circulating in the veins of the mesentery, but believed them to be bubbles of air. In 1760, however, he reviewed the literature and verified the

[8] Reference here is to the edition of 1764. Authority for the earlier edition and specific reference to it on flatness of globules, Milne-Edwards t. i: 43 ftn.

observations of others on the white corpuscles. He cites a long list of writers with as many different names for the white corpuscles.

First Adequate Description of the White Corpuscles

To the young English observer Hewson, whose brilliant career was cut short by an infection received in the dissecting room, goes the credit for the first accurate and significant work on the white cells of the blood. He also added much to the knowledge of the red corpuscles. Vividly he describes the shape of the red cells as they float down the surface of an inclined microscope slide: "Take a small quantity of the serum of human blood, and shake a piece of the crassamentum in it till it is coloured a little with the red particles; then with a soft hair pencil spread a little of it on a piece of thin glass, and place this glass in the microscope . . . and as it flows, some of the particles will be found to swim on their flat sides, and will appear to have a dark spot in their middle; others will turn over as they roll down the glass. No person who sees them turn over can doubt of their being flat; he will see them, in turning, have all the phases that a flat body has; first, he will see them on one side, then rise gradually on the edge, and turn over to the other side." (p. 219) [4] He described the same phases seen as the blood cell circulated in the small vessels of the web of the frog. With characteristic kindness he minimized the error of those who had described the red corpuscles as globular, saying that his own success was due to his chance discovery of the method of diluting the blood with serum or saline, so that the individual cells could be more easily seen. Hewson gave us the foundation for the modern fragility test, in his experiment of diluting the blood with a series of concentrations of saline and observing the gradation from crenation to hemolysis. Hewson also brought out the ingenious argument that the red cells were probably not fatty in nature because they were more readily dissolved in acid than in alkali.

The most significant of Hewson's contributions is his clear description of the white cells and his statement of their relationship

[4] Reference here is to Hewson's *Works*, 1846. According to Nasse, these same writings were published in three volumes in London between 1774 and 1777.

with the lymphatics and pus formation. This work deserves direct quotation somewhat at length: "Numberless small, white, solid particles, resembling in size and shape those central particles found in the vesicles of the blood, are to be seen distinctly gliding down over the stage of the microscope. . . . These particles found in the lymphatic glands likewise agree remarkably in their properties with the central particles found in the vesicles of the blood. . . . These particles are by the lymphatic vessels taken into the course of the circulation, and mixed with the blood, where they are for a time retained, to be again separated from it." (p. 253) "Secondly we have proved that vast numbers of central particles made by the thymus and lymphatic glands are poured into the blood vessels through the thoracic duct, and if we examine the blood attentively, we see them floating in it." (p. 282)

After Hewson the study of the blood was neglected, and the work done on it was of a poorer quality; in fact there was even a backsliding. The French physiologist Magendie in 1817 said that Hewson had probably been seeing blebs of air (t. i: 305), although at a later date (1842) we find him entering into the discussion of the blood corpuscles with some enthusiasm. As late as 1840 a professor of Padua, Giacomini, formally denied the existence of any corpuscles in the blood.[5]

First Steps toward Classification of the Blood Cells

It is not until the second quarter of the nineteenth century that we find any further contributions to the knowledge of the blood corpuscles. About this time there comes what we might term a "Renaissance of Hematology." Volumes appear on the subject of the blood and the reader becomes dizzy from the profusion of theories and the multitude of descriptions of things seen under the microscope. This is the period just prior to the appearance of the first classifications, and to understand the significance of the early classifications and their development, we must consider briefly the many writers whose work contributed only very indirectly to the classification of the blood cells. At this time the physiologists were

[5] This statement is made on the authority of Milne-Edwards, t. i: 45 ftn.; the reference was to *Ann. univ. di med.*, Jan. 1840.

reporting quantitatively the albumin, globulin, sugar, inorganic salt and fibrin content of blood of various animals under all kinds of conditions. The physiology of the blood corpuscles received some attention, but no remarkable progress had been made since the work of Hewson half a century earlier.

Johannes Müller (1844) confirmed Hewson's observations and described white globules which were smaller and fewer in number than the red ones. Emmerson and Reader (1836) published a paper with the promising title *On a peculiar animated Motion observed in the Globules of the Blood.* Their observations were made on blood which had stood for several days, and their drawings contain nothing that can be identified as a normal white cell. Hawley's paper on the same subject is indefinite and not based to any extent on first-hand observation.

Donné (1836) described globules of pus, which were also to be found in the blood of normal individuals, large globules, with uneven borders, not flattened like the red cells, and without a central nucleus visible. He did not distinguish varieties of corpuscles, and regarded the white cell as the altered nucleus of the red rather than as an independent element.

Schwann (1839) was a cytologist, and saw the blood cells as they fit into a classification of all cell types based on degree of differentiation. He made no point of the differentiation of the blood cells into red and white, but related lymph cells to blood cells. " Wenn die Lymphkörperchen Zellen sind, so lässt sich ihre Umwandlung in die Blutkörperchen durch Abplattung und Aufnahme von Farbestoff wenigstens vermuthen." (p. 77) Schwann postulated a " cytoblastema " which was in the exudate, and from which were formed the pus cells, a view similar to that of Mandl, whom we shall consider presently. Each cell type, according to Schwann, has its " cytoblastema " or primordial substance from which it differentiates. Here is a philosophical foreshadowing of the many theorizings which are to occupy so many minds in the study of the histogenesis of blood cells for years to come.

Rudolph Wagner is very widely quoted during this time and subsequently. Most of the references are to his *Beiträge zur Vergleichenden Physiologie des Blutes*, 1833, and *Nachträge*, 1838. In

the 1833 publication the chief concern was with the red corpuscles, and the white ones received only a paragraph, mainly referring to the views of others, and stating that Wagner had as yet done no first-hand researches on the white cells. In 1838, however, the situation was quite different. Wagner described the white blood cells at length: ". . . fand ich zuerst ausser den ganz regelmässigen concaven Blutkörperchen . . . feingranulierte Körperchen . . . Sie fallen von den übrigen Blutkörperchen immer sehr auf, ausser ihrer Form: 1) durch ihre Farblosigkeit, 2) durch einen gewissen Glanz und die Eigenschaft, das Licht stark zu brechen, 3) durch ihr eigentümliches stark granuliertes Ansehen, . . . Indess scheint es mir, dass mehr nur die Oberfläche so granuliert ist." (p. 21) He carefully points out that he does not mean that form of corpuscle which arises from changes in the blood cell which produce fine granulations on its surface and give it a mulberry appearance, i. e., crenation.

In this little book also appears what is probably the first attempt at a differential blood count. Counts were made of the red cells and the white cells appearing in a single field under the microscope, on the blood of the species Bombinator igneus and on the frog. The differential is between " Blutkörperchen " and " Lymphkörperchen," and three counts on beaten blood gave:

" Unter	58	Blutkörperchen,	9	Lymphkörperchen	
"	54	"	10	"	
"	74	"	12	"	(p. 23)

The blood was allowed to stand a short time, and then counted, and the lymphocyte count was exceedingly high, 76 Lymphkörperchen to 55 Blutkörperchen. Wagner says that he put this in to show how careful one should be in research, that the error here was due to the fact that the white cells were lighter and so settled out more slowly and were found on top of the red cells. This work of Wagner's is throughout the work of a careful scientific investigator who is extremely critical of his own methods and his own results.

Barry refers to a private communication, unpublished, from Vogel, quoting: " They (white blood corpuscles) are uneven at the surface, being covered with minute granules; and with the addition of acetic acid, they undergo a peculiar change. There appear simple

granules, two or three in each pus globule (rarely only one or four), which are oval or roundish, having for the most part a somewhat projecting margin, giving them almost a basin-shaped appearance. They are surrounded by a delicate halo or covering which with the continued influence of acetic acid, entirely disappears, so that the isolated granules remain alone." (Barry, 1841 : 221) Vogel, observing the sequence of events after an injury to the skin, saw globules appear in the exudate, first very small, then larger ones, and finally typical pus cells, and from this inferred that the pus cells were formed locally.

Mandl (1840) proposed that all the constituents of the blood except the cells transude through the vessel walls, and that the globules of pus, or "globules fibrineux" of the blood, pus and mucous are identical, but believed that the white cells of the blood were formed only after the blood was drawn. Thus he considered the white blood cells to arise from a primordial diffuse substance in the plasma, either within or without the blood vessels, or possibly never within the blood vessels at all.

Martin Barry, English embryologist and cytologist who from his writings is pictured by this reader at least, as somewhat pompous and a little conceited, wrote several long papers on hematology illustrated by many plates. These plates, the writer says, do not in all points agree with contemporary publications, in the manner of depicting blood cells, but if the reader will look even superficially at them, he will see that the reason for this disagreement is the extreme care with which he (Martin Barry) has prepared them. And though the reader becomes impatient of the padding in these papers, there are certain contributions of value in them. The first description which definitely suggests amoeboid movement in the white blood cells appeared in the paper of 1840. Barry took smears from the ovary and the fimbriated end of the tube of a rabbit. He identified the cells found with the white cells of the blood: "These altered blood corpuscles were in motion; rarely exhibiting a change of place, but presenting a rapid and incessant change of form. I have had many opportunities for observing these motions, which are often such as to be comparable to the writhings of an animal in pain. Sometimes one of the objects in question assumes in a twinkling an

hour-glass shape, as if about to separate into two portions; but as quickly regains its previous form, or assumes a new figure. The condition, however, is by no means one of alternate rest and motion. The motion, as already said, is incessant, and so rapid that it is extremely difficult to catch and delineate any of the forms which arise. . . . They soon cease after removal of the fluid to the microscope. The cessation is, however, very gradual; rapid change of form passing into gentle undulations; and these being succeeded by an alternation of rest and motion. . . . The pellucid centers . . . are not often distinctly visible while the motions are proceeding. Sometimes, however, . . . I have observed . . . the contained pellucid fluid being now central, then on one side, or divided into several parts. The addition of cold water does not immediately arrest these motions. I could not discern any in the remains of the corpuscles after dilute acetic acid had been added." (p. 598) Barry also saw the white cells circulating in the capillary blood, an observation which he says is not at all new.

The French surgeon, physiologist and teacher, Magendie, described in a series of lectures, the red corpuscles and methods of diluting and observing them. He gives the first foreshadowing of a classification of the blood cells: " . . . il en existe de différentes sortes dans le même sang. L'homme, par exemple, nous en montre de constants et d'autres non persistants. Parmi les premiers, nous rangerons les globules rouges qui ont des formes et de dimensions différentes; parmi les seconds, nous trouverons les grands globules blancs, dont on ne connait pas mieux l'usage . . . À côté se placent d'autres globules infiniment plus petits que les rouges et les blancs, et que l'on a pensé appartenir à la lymphe ou au chyle; c'est une conjecture comme une autre . . . basée sur les analogies et non sur les faits." (t. iv: 342) In another lecture Magendie enumerates: 1) red blood corpuscles, 2) large white cells with a single clear nucleus, 3) cells with an appearance " mamelonnée " or " framboisée," and 4) a smaller type, which appear to belong particularly to the lymph or chyle. (t. iv: 372)

Nasse (1842) noted the increase in white cells in well fed animals, and in illness, and was puzzled by the increase found in a patient sick with a fever, who had eaten nothing for many days

and yet had a large number of white cells in the blood. The method of counting must have been very crude, or just a comparison of two fields, for the first blood counting apparatus did not appear until 1870.[64] Nasse clearly describes the white cells: "Ihre Gestalt ist nicht ganz sphärisch, zuweilen mehr länglich oder mehr linsenförmig. Sie sind farblos, feinkörnig, glänzend, brechen das Licht stark, lösen sich nicht im Wasser, aber wohl in Ammoniak auf, zerfallen durch Essigsäure in Hülle und Kern." (t. i: 99) Nasse says definitely that the white cells are not nuclei of the red, but enter the blood stream from the lymphatics: "Die farblosen Kügelchen, aus denen die Blutkörperchen sich entwickeln, kommen, wie vorher gezeigt worden, aus dem Chylus und der Lymphe und erzeugen sich auch wohl noch im Blute." (t. i: 201)

Mandl comments petulantly on the profusion of the literature on the pus and mucous cells at this period, and on the mediocrity of much of it: "Nous avons vu, depuis quartre ans, une foule de petites notes et de mémoirs, sur l'étude micrographique du pus et du mucus. Notre intention est, tout en publiant nos nouvelles recherches, de donner en même temps un aperçu de l'état de nos connaissances sur ces produits; mais nous renonçons avec plaisir à l'énumeration de toutes ces soi-disant observations et recherches, qui consistent dans un examen passager et superficiel du sujet, et dont l'éternel refrain ne fait entendre que: globules grands et globules petits, globules égaux et inégaux, etc." (p. 417)

In all of these writings there is very little actual advance over the work of Hewson, now more than seventy years past, in the knowledge of the blood cells and their relation to the rest of the body. These writers add minor support to Hewson's theories and observations. They describe the blood cells at length. But as for the classification of blood corpuscles, there has been no one, with the exception of Magendie, who has placed any emphasis on a systematic enumeration of the different kinds of cells or made any nomenclature, or who has expressed any clear idea as to the possible significance of the presence of distinctly different kinds of corpuscles.

Virchow in 1858 described a series of steps from a uninuclear to a polynucleated form. He believed that all these were stages in the development of a single cell type, with the small uninuclear

[64] Naegeli, 1931, p. 1.

forms as the youngest and then a cell with an hourglass nucleus, and then a cell with four distinct nuclei. Virchow did not believe that the white blood cells have any connection with the cells of pus. He speaks kindly of those who make this "error," saying that the cells of different individuals vary greatly, and that this error was a very easy one to make. He reports a case of smallpox in which all of the white cells of the blood were uninuclear. In this description and in his subsequent work Virchow is the founder of the monophyletic or unitarian school of hematology.

The Earliest Real Classification of Blood Cells

Out of the profusion of literature of this period, the work of the English anatomist and physiologist Wharton Jones is outstanding. In a well outlined, clear and concise paper on the comparative blood pictures of representative vertebrates from the skate to man, Jones enumerated the forms of cells which he found. He was also a founder of the monophyletic school, for he considered all forms found in the blood to be stages in the development of the red cell. He outlines his classification as follows:

First phase: Granule cell.
- coarsely granular stage.
- finely granular stage.

Second phase: Nucleated cell.
- uncolored stage.
- colored stage.

Third phase: Free cellaeform nucleus or red cell.

In the first phase no nucleus is visible until acetic acid is added. Jones describes the appearance of several nuclei in these cells with acetic acid, but considers this an artefact. Clearly the first phase represents the granulocytes of the later classifications, eosinophiles and basophiles corresponding to the coarsely granular stage, and neutrophiles to the finely granular stage. The second phase represents the lymphocytes and monocytes. Jones says that he has not seen the nucleated cell, colored stage, in the human blood, but infers

it from the fact that he has seen it in mammalian fetal blood and in the adult blood of the horse and the elephant.

Jones also describes the cells found in the chyle from the thoracic duct. There are, he says, more nucleated cells in the chyle and more granule cells in the blood, but all phases seen in the blood are also seen in the chyle, and the only qualitative difference is the small degree of coloring matter which the free cellaeform nuclei have attained.

After the many writings of the preceding years which were of good quality without representing any real progress in the field in which we are interested, the reader finishes Jones's fine paper with a feeling of refreshment.

Wharton Jones marks the height of achievement with the methods in use at his time. In the years immediately following him a few noteworthy contributions were made.

Davaine, a painstaking French physiologist whose name does not occur frequently in bibliographies, gives a finished, finely accurate description of amoeboid movement in the white cells (1850): "Le globule blanc perd sa forme arrondie; d'un point de son circonférence s'avance très lentement une expansion plus transparente que la masse du globule . . . Bientôt après, il se montre sur un autre point une nouvelle expansion qui amène une nouvelle forme au globule, soit que l'expansion première rentre dans la masse primitive, soit qu'elle reste étalée au dehors. . . . Ces expansions et ces retraits se produisent avec une grande lenteur; il faut beaucoup d'attention pour en suivre le dévelopment." (p. 104) He goes on to describe the clear spaces, resembling vacuoles but never disappearing, which are carried always in the central part of the cell, sometimes one, sometimes two or more to a cell. Davaine studied the white cells in the circulating blood of the frog, and says "les globules blancs restent souvent immobiles et comme adhérents aux parois de ces vaisseaux pendant que les globules rouges, beaucoup plus nombreux, suivent le torrent de la circulation." (p. 105)

At about this time we find Kölliker's textbook describing "uninukleäre" and "multinukleäre" white blood cells, described rather vaguely, without any clear indication of amoeboid movement. On the other hand, Milne-Edwards, in his voluminous *Leçons sur*

Physiologie (1857), devoted many pages to description and quotation from others on the various phases of the white cells. He contributed little that was new to the morphology of the white corpuscles from his own observations, but his accurate references and excellent organization of material presented and sources cited have greatly facilitated the investigation of the early periods.

First Warm-Box and Vital Staining Classification

Max Schultze, in 1865, struck a new note which was destined to reverberate for half a century. His "Karminspeicherung" was demonstrated by a warm-box method of vital staining, in all essentials similar to that in use today. He mixed fresh blood with finely ground carmine, protected from air and at a constant temperature of 38° C. He observed the amoeboid movement of the cells and saw them carrying particles of carmine, and saw particles lag in the stream of protoplasm and pass from one part of the cell to another. He tried this also with cinnabar, indigo and aniline blue. He observed that the coarsely granular cells are less phagocytic than the finely granular ones, and was able to induce the coarsely granular ones to take up the more finely dispersed aniline blue. Schultze gives a classification based upon this work:

1. Kleinste farblose Blutkörperchen.
2. Mittelgrosse farblose Blutkörperchen.
3. Grosse feingranulierte farblose Blutkörperchen.
4. Grosse grobgranulierte farblose Blutkörperchen.
5. Feingranulierte Form mit einigen starklichtbrechenden kleinen Körnchen, welche den Übergang der Feingranulierten in die grobgranulierte Form bedingen.
6. Feingranulierte farblose Blutkörperchen bei 38° C. auf dem geheizten Objekttisch, in lebhaft kriechender Bewegung.

Here we have a classification based on the granulation of the cytoplasm and the presence or absence of amoeboid movement. Nuclei are of minor importance in Schultze's picture.

Now followed a fairly unproductive period, when hematology

again awaited the stimulus of an explorer who would supply it with a new set of implements. When this new technique came as a result of the biochemical work of Paul Ehrlich, a wave of study, observation and controversy poured over the entire world, and this wave has not receded to the present day. Thus we enter into the modern phase of the study of the blood cells.

Introduction of Staining for Specific Granulations; the First Modern Classification

The innovation of Ehrlich consisted of the staining of fixed smears and a study of the specific granulations brought out by the stains. Staining had been used in various ways for microscopical work for some years. According to Conn, the first use of dye in this work was by Ehrenberg in 1838, who fed indigo and carmine to small organisms. Several botanists used simple dyes around 1850 and the years following. Conn credits Gerlach with the real introduction of biological staining in 1858, in his use of ammonium carminate for staining of nervous tissue. Ehrlich's first use of his triacid specific stain is usually stated as 1878, and I have found no earlier reference to it. We may note here that Salisbury in 1868, in a handbook on microscopic examination of the blood, outlines a very painstaking and detailed examination, yet makes no mention of any staining methods.

Ehrlich's classification based on the specific granulations found in the blood cells, is the basis of our present-day classification. Ehrlich distinguished five types of specifically staining granules (1879):[6]

α — eosinophile.
β — amphophile.
γ — large granules taking basic dyes.
δ — small granules evident only with basic dyes.
ε — granules taking only neutral dyes.

He described in terms of these granulations six types of leukocytes (1898):

[6] One frequently finds reference to 1878 as the year of this writing. Michaelis, in Paul Ehrlich: eine Darstellung, refers to Verhandl. d. physiol. Gesellsch. Berlin, 1878-9: # 20.

1. Lymphozyten.
2. Grossen mononukleären Leukozyten.
3. Übergangsformen.
4. Polynukleären.
5. Eosinophilen Zellen.
6. Mastzellen.

The " lymphozyten " are described as small cells with a large round homogeneous nucleus, mostly reactive to alkaline dyes, possessing an unevenly staining protoplasm which is interpreted as a reticular structure rather than a granulation. The " grossen mononukleären " are described as two to three times as large as erythrocytes, containing a large, oval, eccentric, weakly staining nucleus, and having a basophilic protoplasm. The " Übergangsformen " develop from the " grossen mononukleären " of the blood, and are distinguished by a deep notching of the nucleus, by a somewhat greater affinity for stains and by the presence of neutrophile or " ε " granules in the protoplasm. The " Übergangsformen " and " grossen mononukleären " together comprise 2-4% of the white blood corpuscles. The " Polynukleären " are described as having a polymorphous nucleus, irregularly bulged and indented, or even having the nucleus disintegrated into three or four distinct parts. The nuclei stain deeply with all stains; the cytoplasm is full of " ε " granules. These cells compose about 70% of all white blood corpuscles. Ehrlich considered the " Polynukleären " to be derived from bone marrow, for the most part fully formed, but partly as the end-stage of the " Übergangsformen," maturing in the blood stream. The " Eosinophilen " are distinguished by a coarse, round granulation staining with acid dyes, " α " granulation. The nucleus is similar to that of the " Polynukleären " though less deeply staining. These cells are given as 2-4% of all white blood cells. The " Mastzellen " composing 0.5% of all white cells in normal blood, are described as intensely basophilic, containing basophilic granules of irregular size and uneven distribution, having a lightly staining polymorphous nucleus.

Essentially we have here the modern classification. The terminology has undergone some changes. This method of differentiation

is today the basic method of clinical hematology, with certain modifications of the dye used. Ehrlich gives us what is certainly the earliest modern differential count. To note the changes in clinical terminology we shall glance presently at the varying forms used in reporting differential counts in purely clinical writings.

With Ehrlich we have the founding of the polyphyletic or dualist school of hematology, in contrast to the school founded by Virchow which derives all white blood cells from a single source, the monophyletic school. We shall say more of these schools and their adherents presently.

From this point there are two aspects of the classification of blood cells which we must consider, and we may well consider them separately. One is the obvious classification of the mature formed elements into certain groups. Such classifications are found in clinical reports and textbooks of the more elementary type. Tracing their development since the time of Ehrlich consists mainly in noting the variations in terminology, since the essential classification has not changed. The second deals with the more abstruse concepts behind the classification, based on and influenced by the constantly increasing investigations into the biology, histogenesis and pathology of the blood cells. Here we attempt to link the blood cells with the rest of the body and see them as functional parts of an organism.

Modifications in Terminology in the Modern Period

Ehrlich is to my knowledge the first to use the term " leukocyte " in blood terminology. Kanthack and Hardy say that the French physiologists used the term earlier to designate wandering cells, but give no references. Following Ehrlich's introduction of it, the term came into wide use, and very soon became established. There has been, and still is, an absence of uniformity in the usage of this term. By some it is used to designate all of the white cells of the blood; and by others to designate precisely the granular cells.

The division of the white cells into two large groups, granular and non-granular, was initiated by Wharton Jones, who named some of his cells " granule cells," acknowledging his indebtedness to Vogel who had used this term to designate the cells in an inflammatory exudate. Schultze (1865) and Kanthack and Hardy (1894) used

granules as a distinguishing property of blood cell types, although neither used the word "granulocyte." Schott (1909) gives "ungranulierten Zellen" under which are "kleine Lymphozyten" and "Makrophagen"; and "granulierten Zellen" under which are "feingranulierte (amphophile) Leukozyten," "grobgranulierte (eosinophile) Leukozyten," and in the dog "feingranulierte (pseudoeosinophile) Leukozyten"; and, described but not named, basophiles. Buchanan (1909) gave a classification very similar to Schott's. Pappenheim (1911) describes "Mononukleäre Agranulozyten" under which are "kleine und grosse Lymphozyten," and "grosse Monozyten"; and "polynukleäre Granulozyten" with the usual three sub-groups. In the following years the term "granulocyte" is used widely in all languages. "Agranulocyte" was used by English writers and to some extent by others during these years, though in recent years there has been a tendency to drop this term. The German writers have consistently used the term "uninukleäre" to designate all one-nucleated white blood cells. This term is not equivalent to our "mononuclear," for the Germans use both terms, and we have taken over the word "mononuclear" in the sense which Ehrlich introduced, the same sense in which the Germans use it. The term "uninukleäre" is a useful one, and I shall use it occasionally in this paper in the usual German sense.

Terms implying relationship with the lymphatics have been in use since long before the earliest classifications. Boerhaave used the term "lymphatic globules" without ascribing a lymphatic origin to the white cells. Hewson believed that his "central particles" arose in the lymph glands, but did not use such a term for them. Wagner, Milne-Edwards and many others used "Lymphkörperchen" and "globules lymphatiques," as general terms for all the white cells. Ehrlich introduced the term "lymphocyte" with its modern meaning. The term has been in universal use since that time. It was seriously challenged by Ferrata (1908) who rejected the term lymphocyte and used "uninukleäre" exclusively for awhile. However, by 1918, Ferrata had reconciled himself to the use of the word "linfocito."

The term "monocyte" comes into use around 1910. Naegeli used it in 1909; Pappenheim in 1911. Naegeli clarified the status

of the cell type in 1912. Both of these writers were extremely prolific around this time, and I have not had access to all of their writings. Pappenheim (1908) did not use the term "Monozyt" nor did Ferrata (1908), nor did either quote Naegeli as using it. Therefore I am inclined to believe that Naegeli introduced the term in 1909 using it in its present sense. However, the term "Transitional" was still in very general use at that time, used in the sense of Ehrlich, to designate the large cell with indented nucleus. The term "Transitional" or "Übergangsform" was retained long after it was realized that this was a misnomer, and is still found occasionally.

Ehrlich's classification of the three groups of granular cells is still accepted essentially as he gave it. "Polynuclear" has given way to "polymorphonuclear." Kanthack and Hardy (1894) objected to the term "polynuclear" because they believed that there was just one nucleus, the parts being connected by a protoplasmic bridge. They did not, however, suggest a better term. Grawitz (1896) used the term "polymorphkernige," and this is to my knowledge its first appearances. However, Grawitz must not have had very strong convictions on the subject, for he frequently reverted to the shorter form. Howell, too, in his textbook of 1897 used "polymorphonucleated leukocyte" interchangeably with "polynucleated." Ehrlich still used "polynukleäre" in 1900. Jones (1904) used "fine oxyphiles." Pappenheim frequently used "segmentiertkernige" and "polymerisiertkernige." "Segmentiertkernige" was also used by Dickson (1908). As late as 1929 Stern used "segmentkernige." Ferrata frequently deplored the use of "polynucleäre" and used "leucociti polimorfi granulosi" and when writing in German "polymorphkernige"; he was very consistent. By about 1920 the term "polymorphonuclear" interchangeably with "neutrophile" is in practically universal use in English and American medical journals, and in general use elsewhere, though the older terms frequently recur in continental and particularly in German writings and clinical reports.

The nomenclature of the eosinophiles has undergone practically no change. Ehrlich named them, and the name has scarcely been challenged. "Oxyphile" and "acidophile" occasionally occur.

The term "Mastzellen" introduced by Ehrlich for the basophilic

granulocytes was used quite generally in all languages until about 1900. Just who first used the name "basophile" as a substantive is not clear. Many authors in the early twentieth century used "Mast cells (basophiles)" and gradually the clinical reports show more and more often columns headed "Basophiles." At present "Basophile" occurs in English and American writings almost exclusively, while continental Europe employs either, and the Germans prefer Ehrlich's original "Mastzellen."

Other Influential Classifications during Ehrlich's Period

Not everyone, of course, immediately accepted Ehrlich's biochemical basis of classification. Grawitz said that it placed too much reliance on a postmortem biochemical reaction. Kanthack and Hardy made the same objection. Hayem in 1889 gave three groups of cells, with descriptions only: the first group recognized as small lymphocytes, the second as monocytes, transitionals and probably neutrophiles, the third as eosinophiles and possibly basophiles. Kanthack and Hardy (1894) deny the existence of neutrophile granules, and give the following classification:

1. Oxyphile cells.
   coarsely granular or eosinophile.
   finely granular.
2. Basophile cells.
   coarsely granular.
   finely granular.
3. Non-granular or hyaline cells.
4. Immature cells or lymphocytes.

Howell (1897) doubted whether the granules were a permanent property of the cell, and proposed a "safer classification":

1. Lymphocytes.
2. Mononuclear leukocytes, distinguished by abundant protoplasm and amoeboid movement.
3. Polymorphous or polymorphonucleated leukocytes, with nucleus either divided into separate parts or lobed, showing amoeboid movement.

Simon (1897), who is spoken of abroad as an outstanding American hematologist, gives the following scheme, essentially in accord with Ehrlich:

1. Small mononuclear leukocytes.
2. Large mononuclear leukocytes.
3. Polynuclear neutrophiles or polymorphonuclear leukocytes.
4. Transitionals between 2 and 3.
5. Eosinophiles.
6. Basophiles.

Stöhr (1898) gives a classification which is reminiscent of an earlier day:

1. The smallest leukocytes, with a large round nucleus, a narrow zone of protoplasm, and little activity.
2. Those of the second variety, with spherical or deeply cleft nucleus, and a large amount of protoplasm; or may have a segmented nucleus; very active.
3. Those of the third variety, with heavy granules.

Arneth (1905) proposed to classify the cells according to number of nuclei and the form of these nuclei. He gave eleven different groups of neutrophiles, beginning with the myelocyte, and going through the five-lobed stage which he considered the oldest. This system was based on the same principle as the modern Schilling count.

Clinical Usage: Blood Count Terminology

It will be of interest to note briefly the enumerations which have been used in clinical reports from time to time. The following have been picked almost at random, and serve to illustrate the absence of standardization during the first two decades of the present century. Since comment is for the most part unnecessary, the enumerations will be given simply with the name of the author:

Bohm and von Davidoff (1900):

1. Large and small lymphocytes.
2. Mononuclear leukocytes.
3. Transitional leukocytes.
4. Leukocytes, either polymorphonuclear or polynuclear.

Bryant (1903):

1. Polymorphonuclear leukocytes.
2. Lymphocytes.
3. Large mononuclear leukocytes.
4. Eosinophiles.
5. Transitionals.
6. Mast cells.

Peacocke and Scott (1903): (splenic anemia).

1. Eosinophiles.
2. Polymorphonuclear leukocytes.
3. Mononuclear leukocytes.
4. Lymphocytes.

Steven (1904): (lymphatic leukemia).

1. Large lymphocytes.
2. Small lymphocytes.
3. Polymorphs.
4. Eosinophiles.

Kurpjiuweit (1904):

1. Polynukleäre Leukozyten.
2. Lymphozyten.
3. Mononukleäre Leukozyten.
4. Eosinophilen Leukozyten.

Alder (1919):

1. Neutrophilen, polymorphkernige Leukozyten.
2. Eosinophilen.
3. Mastzellen.
4. Monozyten.
5. Lymphozyten.

MacCallum (1921):

1. Polymorphonuclears.
2. Large mononuclears.
3. Small mononuclears.
4. Transitionals.

Further examples could, of course, be given almost without limit, but would be superfluous.

The term " Transitional " gradually disappeared. Aschoff (1909) and Simon (1914) included it in their textbooks, but by 1918 Simon had discarded it, saying that the " transitional cells " were merely old large mononuclears and should be grouped under this heading.

During the last two decades the great majority of reports follow a fairly definite form, enumerating:

1. Polymorphonuclears or Neutrophiles.
2. Eosinophiles.
3. Basophiles.
4. Lymphocytes, which may be divided into large, medium and small.
5. Monocytes.
6. Unclassified.

(*To be continued*)

PERSONAL REMINISCENCES OF PROFESSOR JOHN J. ABEL *

DAVID I. MACHT

The present paper is not intended to be a biographical sketch of Professor Abel, who died May 26, 1938, at the ripe old age of eighty-one. A good sketch of his life by Professor E. K. Marshall, Jr., will be found in *Science* for June 24, 1938. My object in giving this paper is to assay an appraisal of Professor Abel as a scientist in general and as a pharmacologist in particular and to dwell on some traits of his character which would naturally be best known by those intimately associated with him for long periods. Inasmuch as I have been associated with Professor Abel for approximately twenty-five years (from 1909 to 1935, to be exact), such personal reminiscences as I can offer may enable posterity to evaluate better the contributions of this great man to the progress of science.

Pharmacologists in the United States, and perhaps also in other countries, may be broadly divided into two classes. One group is composed of the so-called pharmaceutical school which considers pharmacology a branch of pharmacy and is interested mostly in regarding drugs from the pharmaceutical point of view. On the other hand, there is that group to which Professor Abel belonged, which regards pharmacology as an important division of biology. In the broadest sense of the word, pharmacology means to them that science which is the meeting-place of the physicochemical sciences, on the one hand, and of the biological sciences, on the other. Such a view of pharmacology Professor Abel held, a view to which many of his pupils also subscribed. As my numerous writings testify, I have ever been a strong exponent of this conception of the subject.

Inasmuch as pharmacology is the meeting-place of the physicochemical sciences and the biological sciences and inasmuch as one man can hardly be preeminent in both these fields, pharmacologists of Professor Abel's school may be divided into two groups, those

* Read before the Section on Historical Pharmacy at the Annual Meeting of the American Pharmaceutical Association at Atlanta, Georgia, August 25, 1939.

engaged primarily in physiological experimentation and those most interested in the chemical aspects of pharmacology. It is well known that Dr. Abel leaned strongly toward the latter group. He was always interested in organic chemistry and it was his greatest delight to search for and isolate active principles of drugs. This is well established by his pioneer work on adrenalin, the pituitary gland and the endocrine organs as well as by his researches on the poisons of the tropical toad, *Bufo agua*, in which I have had the privilege of collaborating with him.

While Professor Abel regarded pharmacology as one of the great divisions of biological science, he never lost sight of the fact that it is first of all a handmaid to medicine. Indeed it was his opinion to the last that one could not be a good pharmacologist unless he had had a medical training which, of course, did not mean that every pharmacologist had to be an M. D. Professor Abel insisted, however, that every pharmacologist should not only be familiar with the basic medical sciences but also have some acquaintance with clinical medicine. It is hardly necessary for me to expatiate on the importance of this view which, to say the least, extends the usefulness of the pharmacologist to the public because he can then contribute whatever lies in his power to practical therapeutics and, after all, that is the subject in which the patient is interested. Of course, every one knows that Professor Abel actually went further and opposed granting of the degree of Ph. D. in pharmacology.

Although his predilections were always for the natural sciences, Professor Abel belonged to that older class of leaders in medicine which did not underestimate the value of the humanities and the historical approach to scientific problems. From the standpoint of general science, I have always admired Professor Abel for his wide reading and extensive contacts with numerous sciences. This, of course, was the logical outcome of his broad view of pharmacology. I recall numerous conversations with him at the lunch table or outside in which we discussed problems of physics, zoölogy, botany and, naturally, chemistry. One of Dr. Abel's hobbies, in which he indulged when he had a bit of leisure, was mathematics.

Professor Abel rigidly adhered to the historical approach to medical problems and the historical method of tracing development of

pharmacological discoveries. The casual reader little suspects the infinite labor and time which such research usually consumes. I, who have often helped Professor Abel in such work because of my fondness for philology, can bear testimony to many interesting incidents in this connection. Thus, for instance, the historical introduction to our work on the poisons of *Bufo agua* not only necessitated incursions into Greek and Latin antiquities but involved a search of Semitic literature, of Chinese materia medica and of East Indian as well as West Indian and South American folklore. Another example of Dr. Abel's intense interest in the historical aspects of his subjects is afforded by his Mellon Lecture on Endocrinology.

He exercised even greater painstaking scrupulosity in tracing the modern experimental progresses in pharmacology. Here he believed religiously in giving proper credit to the early pioneers who opened paths leading to recent discoveries. Excellent examples of such admirable exposition are to be found in Professor Abel's papers on insulin and on the pituitary gland.

Those associated with him were always profoundly impressed by his magnetic yet simple personality, his unswerving devotion to his ideals, his manifold interest in every department of natural history and, above all, by his extreme precision in all experimental undertakings irrespective of what line of scientific research he pursued. If attention to the minute details which escaped the ken of ordinary mortals be one of the earmarks of the great scientist, then certainly Dr. Abel possessed this prerequisite in the highest degree. This faculty he unconsciously communicated to his major pupils. Thus, for instance, long before modern biophysics had revealed the importance of ultraviolet rays, and long before the discovery of the deteriorating effects of polarized light on drugs and chemicals, Professor Abel used to insist on protecting his materials from the possibly deteriorating action of even ordinary reflected light. His scrupulous precision and meticulous accuracy in respect to minutiae logically led him to the cultivation of microchemical methods, in which he became adept.

The question has often been asked, " Why did not Professor Abel write a textbook on pharmacology? " This question can be answered by myself, who was associated with him longer than any of his pupils

and delved with him into both the historical and scientific aspects of the subject matter on which he worked. We often discussed the idea of making a text and once made plans to write one but active interest in research problems distracted our thoughts and we never found sufficient time for such a task. Dr. Abel had no time for compilations but preferred to publish original articles dealing with scientific researches instead, and it was only in later years that he consented to write papers on such general topics as the relation of chemistry to medicine and the importance of endocrinology, his object being to arouse more interest among those who were in a position to do something to promote such work.

Even on vacations and during his leisure moments Professor Abel never turned completely away from his research problems, as the following contradictory letter amusingly indicates. When he left town for the summer he usually took with him many books and often planned researches and even began to work on them sometimes in his summer home.

MT. CRESCENT HOUSE
RANDOLPH, N. H.

August 23, 1919.

Dear Dr. Macht:

Thank you very much for writing me twice recently *and setting my mind at ease about matters in the laboratory. It is such a pleasure to be* able to drop everything as I am doing—putting off letters and tasks of all sorts—and studying things *far removed from the year's work in Baltimore*!

Dr. B——— ran up from Boston for a day and had many interesting things to tell us about his life in Macedonia and elsewhere during the past two years. R——— has just returned from France safe and sound, though entirely unsettled in respect to his life plans like so many other young fellows who have been abroad. B——— is going into clinical medicine but may return to us for a year. He has offers both from Boston and the Rockefeller Hospital in New York.

Thanks for sending me your paper with Matsumoto. I have not got round to reading it. My reprints, i. e., the 20 that I asked for have not yet reached me.

Thanks for your good opinion of the B-I paper. *I wish I could get back to work tomorrow—am planning some new work in leisure moments.*

Hope your family is well. Was glad to hear about your Maecenas! With best regards, I am

Sincerely yours,
John J. Abel

Professor Abel's attitude toward pharmacy and drug manufacturers is of particular interest to this assembly and is a topic which has been greatly misunderstood by many pharmacologists as well as pharmacists. I wish to dwell at some length on Professor Abel's position in this connection because I am familiar with aspects of this important subject which are not generally known. Dr. Abel's early experiences with one or two large drug firms were not of the most fortunate kind and the unfair treatment he received at the hands of a few unscrupulous individuals was calculated to make him wary of drug manufacturing concerns in general. How the sins of certain individuals are visited on the large group of persons whom such individuals misrepresent is well illustrated by an episode in the history of the American Society for Pharmacology and Experimental Therapeutics. This society, founded December 28, 1909, was organized by Professor John J. Abel, who was its president for four successive years, and it cannot be denied that it was largely through his insistence that an extraordinary by-law was incorporated into its constitution. This remarkable provision, which constitutes Section 2 of Article III and is amplified by Paragraph B of Section IV, reads as follows:

> No one shall be admitted to membership who is in the employ, other than in the capacity of a consultant, of any organization concerned with the manufacture or sale of medicinal products. In cases where the interpretation of this section is not clear, the Council shall have the power to make the necessary interpretation in each instance. (Section 2 of Article III)
>
> Entrance into the employ, other than in the capacity of a consultant, of any organization concerned with the manufacture of medicinal products shall constitute forfeiture of membership. In cases where the interpretation of this paragraph is not clear, the Council shall have the power to make the necessary interpretation in each instance. (Paragraph B of Section IV)

It would not be fair to the memory of Professor Abel, however, to convey the impression that his attitude on this subject never changed. Certainly at least two decades before his demise he felt the injustice of the bylaw and meditated on its abrogation. We also

know that his relations with various drug firms as, for instance, with the Armour Co., and with Hynson, Wescott & Dunning, were of the most cordial and coöperative character.

Future historians will undoubtedly mark the year 1926 as an epoch-making era in the history of American pharmacology. On May 14 of that year a memorable meeting took place in the offices of Professor Abel at the Johns Hopkins Medical School. The participants in that conference were Professor John J. Abel, President Frank J. Goodnow of the Johns Hopkins University, Professor Walter E. Dixon of Cambridge University and Mr. H. A. B. Dunning, President of the firm of Hynson, Westcott & Dunning, Baltimore. The meeting had been precipitated by Mr. Dunning's invitation to Dr. David I. Macht, one of Professor Abel's associates, to become the director of the newly established pharmacological research laboratory connected with his firm. Dr. Macht was reluctant to accept the offer because of the statutory discrimination of the American Pharmacological Society mentioned above, and Mr. Dunning wished to discuss the subject in detail with these representatives of two great universities. How could private research laboratories connected with industrial concerns contribute to the advancement of research and scrupulous cultivation of scientific methods as far as drug manufacture was concerned if the best men trained by universities were to be ostracized by their colleagues as soon as they agreed to direct such laboratories? When this problem was frankly broached by Mr. Dunning, a warm discussion was precip[illegible]ted. The serene, judically minded President Goodnow, student of constitutional and international law, was more than surprised to learn of such an evident violation of American fair play, which could not be condoned by the Bill of Rights and was palpably unconstitutional. The admirable and no less plainspoken leader of England's pharmacologists, Professor Walter E. Dixon, raised his hands in horror and loudly proclaimed that such discriminatory tactics were never dreamed of in England, where the object of both government and university scientists was to coöperate with industry in the friendliest manner possible. Most important of all, Professor Abel agreed that the American Pharmacological Society's flagrant discrimination against pharmacologists connected with the laboratories of drug

houses had outlived its usefulness and he, the dean of American pharmacology, promised that he would do all in his power to bring about the repeal of the obnoxious by-law. Dr. Abel, however, was far ahead of his contemporaries. In spite of his honest efforts to secure its abrogation, the quaint taboo is still in force. The attitude of foreign pharmacologists on this subject can perhaps be best expressed by a letter which I received from Professor W. Straub in 1929. This great German pharmacologist wrote as follows:

München, Nussbaumstr. 28
13 Juli, 29

Herrn Dr. David I. Macht,
Baltimore, Maryland.

Sehr geehrter Herr Kollege!

Ich danke Ihnen verbindlichst für Ihre Sendung Ihrer Arbeiten und den Weihrauch, der mich besonders interessierte. Ebenso hat mich Ihre Auseinandersetzung über Zweck und Ziel der Pharmakologie interessiert. Ich habe auf meiner Reise, die mich an so viele Universitäten brachte, natürlich allerlei Eindrücke bekommen, die jetzt anfangen aus dem kolloiden Zustande auszukristallisieren. So hat mich Ihr Urteil über die amerikanische Pharmakologie zu allerlei Vergleichen angeregt. . . . Ich glaube man muss die Sache evolutionistisch betrachten. Die amerikanischen Pharmakologen lieben noch sehr die Analyse, wie das bei uns die Anfänge des Fachs waren. Das isoliert natürlich im Kreise der medizinischen Wissenschaften, umsomehr, wenn das physiologische Problem am Arzneimittel das pharmakologische verdrängt. Noch zu den Zeiten, in denen ich zum Fach kam, war bei uns die Pharmakologie ein weltfremdes Fach, dessen Nutzen weder der Kliniker noch der Chemiker einsehen wollte. Diese splendide Isolation ist von Schmiedeberg geradezu gepflegt worden. Inzwischen hat sich das sehr geändert, wir haben Anschluss an die Klinik gefunden, es ist geradezu Mode, dass der junge Kliniker in einem pharmakologischen Institut einmal gearbeitet haben muss, da unsere Chemiker jetzt mit Vorliebe "wirksame Stoffe" bearbeiten, sind sie auf uns mehr denn je angewiesen und schliesslich zeigt sich der practische Wert der Pharmakologie bei uns besonders in der Zusammenarbeit mit der Industrie, sehr zur gegenseitigen Befruchtung. Es ist bei uns nicht anstössig, eine Erfindung zu patentieren und industriell auszuwerten und der rigoröse Standpunkt der beiden von Ihnen zitierten Paragraphen der Amerikanischen pharmakologischen Gesellschaft ist mir nicht recht verständlich.

Als ich unsere deutsche Gesellschaft gründete, habe ich geradezu Wert darauf gelegt, dass die grossen Fabriken als solche and ihre Leiter unsere Mitglieder wurden. Diese Zusammenarbeit hat sich jetzt noch vertieft. Ich weiss nicht wieso man bei Ihnen einen so rigorösen Standpunkt hat und

würde gerne einmal darüber etwas von Ihnen hören. Ich könnte mir denken, dass auch bei Ihnen dieser Zustand nur ein Durchgang ist, Ihre grossen elektrischen und chemischen Konzerne haben doch schon den Anfang damit gemacht, die besten Leute von den Hochschulen wegzuholen, warum sollen sie nicht an den Hochschulen bleiben und mit den Fabriken zusammenarbeiten?

Ueber diese Dinge hätte ich gerne mündlich mit Ihnen in Baltimore gesprochen, leider war meine Zeit so knapp geworden, dass es nicht mehr möglich war.

Ich geniesse noch sehr an den reichen Eindrücken meiner Reise, möchte aber trotzdem jetzt nicht in Baltimore sein, es muss eine schreckliche Hitze sein und ich bedaure aufs lebhafteste die armen Physiologen, die im August Amerika besuchen.

Mit besten Grüssen

Ihr ergebenster Straub

28 Nussbaumstrasse
München
July 13, 1929

Dr. David I. Macht,
Baltimore, Maryland.

My honored colleague:

I thank you much for sending me your reprints and also the book on incense, which was of special interest. I was also greatly interested in your exposition of the aims and methods of pharmacology.

In my travels in the United States, where I visited so many universities, I naturally received all kinds of impressions which are only now beginning to crystallize out of their colloidal state. For this reason your views on American pharmacology stimulate me to all kinds of comparisons.

I believe that we must look upon this matter from the evolutionary point of view. American pharmacologists have still a predilection for analytical studies as we had when pharmacology was in its infancy here. Naturally such an attitude isolates pharmacology from the rest of the medical sciences especially when the physiological take precedence of the pharmacological problems among medical men. Even when I began to specialize in our subject, pharmacology among us was regarded as a strange specialty in which neither clinician nor chemist could discover any useful purpose. Such a splendid isolation was even encouraged by Schmiedeberg, the father of pharmacology.

Since that time, however, things have changed a great deal. We began to keep in touch with the clinics and at the present time it is quite the fashion for young clinicians to spend some time working in a pharmacological

institute especially as our chemists now like to work up so-called "active principles." They are thus obliged to be more dependent on us and the practical value of pharmacology begins to be better appreciated. This is a good thing as it establishes between pharmacologists and industry a cooperation that is of mutual advantage.

Here it is not considered shocking to patent a discovery and make much use of it industrially so that I cannot quite comprehend the truculent by-law from the constitution of the American Pharmacological Society. When I founded our German Pharmacological Society, I stressed the importance of admitting to its membership the scientific directors of big drug manufacturing concerns.

I do not see how pharmacologists among you can maintain such a ridiculous, unfriendly attitude, and I should like to hear more from you regarding this matter. Certainly your great electric and chemical concerns began long ago to snatch your best workers from the higher institutions of learning. Why should not these same scientists retain their connection with the universities and cooperate with industrial firms?

Concerning all these things I wished to talk with you in Baltimore but could not because my time was so limited. I am still ruminating over the manifold impressions received on my journey but I have no desire to be in your city now. The heat in your country is frightful and I pity the poor physiologists who plan to attend the August meeting in America. With best regards, I am, devotedly,

Straub.

There is no need to dwell in this place on the results of such discrimination. In its inception the Pharmacological Society may have been justified in restricting membership to university men. At that time there were but few research laboratories among drug manufacturers and patent medicine exploiters had much to say. While the drug industry has developed, however, and great pharmaceutical firms have established a dozen or more magnificent research laboratories, the evolution and progress of the American Pharmacological Society has been retarded. Upon its rostra cannot be found the names of some of the most successful scientists in the field of experimental pharmacology and therapeutics, scientists who have chosen as their fora the American Physiological Society, the American Biochemical Society, the important section on medicinal chemistry of the American Chemical Society, the scientific section of the American Pharmaceutical Society and other scientific organizations for the communication of their researches. Now that the new Food

and Drug Act is in force, this state of affairs is bound to become more demoralizing because the number and personnel of privately endowed research laboratories will increase.

Ten years after receipt of the foregoing letter from the great pharmacologist Straub and, by a curious coincidence, thirty years after the founding of the American Pharmacological Society, I count it a privilege to pay this tribute to Professor Abel and disclose his attitude towards pharmacy and the drug industry in his later and riper years. A well-known American writer has made the following trenchant statement, "The most civilized minds of our generation are those of scientists who have had the energy and the curiosity to master the humanities." Every really great scientist is imbued with love of truth and passion for impartiality, impersonal fair play and a strong sense of justice in all circumstances of life. Such a scientist was Professor John J. Abel and his final attitude towards pharmacy and the drug industry, as distinguished from that he held at the beginning of his career, serves but to reveal his breadth of vision and that elasticity of mind which marks the progressive scientist.

WAS SERVETUS INFLUENCED BY IBN AN-NAFĪS?

OWSEI TEMKIN *

Until a few years ago the Spanish heretic, Michael Servetus, was generally considered the first to have described pulmonary circulation.[1] Now, however, we know that in this discovery Servetus had been anticipated about three hundred years before by an Arabic physician, Ibn an-Nafīs. This fact was laid down in 1924 in the thesis of Muḥyī ad-Dīn aṭ-Ṭaṭāwī.[2] Since this thesis was never printed, it is through two important publications of M. Meyerhof that we have become more fully acquainted with the details of Ibn an-Nafīs' life, work, and discovery.[3]

In many respects the statements of Ibn an-Nafīs and Servetus show definite similarity, and the question arose whether Servetus might possibly have been acquainted with Ibn an-Nafīs' work. It was, however, not possible to establish any such connection. Ibn an-Nafīs' "Commentary on the Anatomy in the Canon of Ibn Sīnā" has not been translated into Latin[3a] and no intermediary

* This article was prepared about two years ago as a contribution to the intended "Festschrift" for the 70th birthday of Professor Max Neuburger. In publishing it now in the Bulletin I wish to express my esteem for the great Viennese historian of medicine.

[1] The expression "pulmonary circulation" has to be used with the necessary qualifications pointed out by M. Neuburger, "Zur Entdeckungsgeschichte des Lungenkreislaufes," *Arch. Gesch. Med.*, 23, 1930, pp. 7-9.

[2] Cf. Meyerhof in *Isis*, p. 102.

[3] "Ibn an-Nafīs und seine Theorie des Lungenkreislaufs" in *Quellen und Studien zur Geschichte der Naturwissenschaften und der Medizin*, Band 4, Berlin, 1935, pp. 37-88, and "Ibn An-Nafīs (XIIIth cent.) and his theory of the lesser circulation," *Isis*, No. 65 (Vol. XXIII, I), 1935, pp. 100-120.—Cf. also S. Haddad and A. Khairallah, "A Forgotten Chapter in the History of the Circulation of the Blood," *Annals of Surgery*, 104, 1936, pp. 1-8.

[3a] Sarton, *Introduction to the History of Science*, Vol. II[3], Baltimore, 1931, p. 1100 cites "Ebenefis philosophi ac medici expositio super quintum canonem Avicennae ab Andrea Alpago bellunensi ex arabico in latinum versa. This is a part of the Latin Ibn Sīnā edition of Venice 1547." I have not seen this work, but since the 5th book of the Canon deals with pharmacology, it has scarcely any bearing upon the present subject.

source is known. It had, therefore, to be assumed that Servetus developed his theory independently from Ibn an-Nafīs.[4]

It seems to me that this result can be furthermore supported by some internal evidence. Meyerhof has already pointed out that Servetus expresses two ideas not to be found in Ibn an-Nafīs: "Was SERVEDE mehr hat, ist ausser der 'gelben' Farbe des oxydierten Blutes, die er möglicherweise an Schlachttieren beobachtet haben kann, sein Argument, das ich oben nicht wiedergab, dass die Lungenarterie zu dick sei, um allein der Ernährung der Lunge zu dienen."[5] But whereas these could be interpreted as merely additional arguments of Servetus, there are, besides, two anatomical points where his conception is *different* from that of the Arab:

1. Ibn an-Nafīs is very definite about the impossibility of any blood passing directly from the right to the left cavity of the heart. To quote Meyerhof's translation, he says: "*But there is no passage between these two cavities*; for the substance of the heart is solid in this region and has neither a visible passage, as was thought by some persons, nor an invisible one which could have permitted the transmission of blood, as was alleged by GALEN. The pores of the heart there are closed and its substance is thick."[6] And again: "Therefore the contention of some persons who say that this place"—i. e., the septum—"is porous, is erroneous."[7] Servetus, on the other hand, does not mention the pores at all. Speaking of the transmutation of venous into arterial blood, he says: "Demum, paries ille medius, cum sit vasorum et facultatum expers, non est aptus ad communicationem et elaborationem illam, *licet aliquid resudare possit*."[8] The admission that a little blood may sweat through into the left cavity makes it even likely that Servetus would not have

[4] Cf. Meyerhof, *Isis*, pp. 119-120. Cf. also Goyanes, J., *Miguel Serveto, teologo, geografo y medico, etc.*, Madrid, 1933, pp. 219-223.

[5] Meyerhof, *Quellen und Studien*, p. 87. For the interpretation of Servetus' designation of the color of arterial blood as "flavus" cf. Izquierdo, J. J., "A New and More Correct Version of the Views of Servetus on the Circulation of the Blood," *Bulletin of the Institute of the History of Medicine*, Vol. V, Baltimore, 1937, p. 920.

[6] Meyerhof, *Isis*, p. 116.

[7] *Ibid.*, p. 117.

[8] *Christianismi Restitutio*, reprint edition of 1791, p. 171. (Italics mine.)

absolutely denied the existence of pores. For, as is proved by the first edition of Vesalius' *Fabrica*, it was just through such invisible pores that blood was believed to *sweat through*.[9]

2. The other point refers to the way in which Ibn an-Nafīs and Servetus visualized the passage of blood from the pulmonary artery to the pulmonary vein. Ibn an-Nafīs believed that " there exist perceptible passages . . . between the two [blood-vessels]." [10] After some blood had " filtered through " the wall of the pulmonary artery it would find " the great quantity of air distributed in the cells of the lung and is mixed with it in order to acquire the aptitude to generate the vital spirit." [11] Then, we may complete the picture; it would filter into the pulmonary vein which, according to Ibn an-Nafīs, " has thin substance in order to facilitate the reception of the transsuded [blood] from the vein in question." [12] Servetus' remarks on this subject suggest quite a different theory, although he is not very explicit about it. After the above quoted passage concerning the septum of the heart he adds: " Eodem artificio, quo in hepate fit transfusio a vena porta ad venam cavam propter sanguinem, fit etiam in pulmone transfusio a vena arteriosa ad arteriam venosam propter spiritum." [13] But he does not describe exactly how he imagined the transition of the blood from the portal vein to the vena cava. He supports his contention of a communication between the two ventricles via the lungs by the equally unclear argument: " docet coniunctio varia, et communicatio venae arteriosae cum arteria venosa in pulmonibus." [14] But then, in a different connection, he develops a surprising hypothesis. Since Servetus believed the blood to be the seat of the soul he had to reconcile this view with the obvious physiological rôle of the nerves. This he did by assuming that in the brain the arteries, by means of the meninges, con-

[9] Vesalius, *De Humani Corporis Fabrica*, Basileae, 1543, p. 589: " Ex his foveis nullae (quod sensu saltem comprehendi licet) ex dextro ventriculo in sinistrum penetrant, adeo sane ut rerum Opificis industriam mirari cogamur, qua per meatus visum fugientes ex dextro ventriculo in sinistrum sanguis resudat."

[10] Meyerhof, *Isis*, p. 116.

[11] *Ibid.*, p. 117.

[12] *Ibid.*, p. 116. The " vein in question " is the pulmonary *artery*.

[13] *L. c.*, p. 171.

[14] *Ibid.*, p. 170.

tinued into the nerves. This connecting part he considered a new kind of vessel, and he thought that a similar type of vessel was also to be found in the lungs, connecting the pulmonary artery with the pulmonary vein: " Hi plexus intima omnia cerebri penetrant, et ipsos cerebri ventriculos interne succingunt, vasa illa secum complicata, et contexta servantes, usque ad nervorum origines, ut in eos sentiendi et movendi facultas inducatur. Vasa illa miraculo magno tenuissime contexta, tametsi arteriae dicantur, sunt tamen fines arteriarum, tendentes ad originem nervorum, ministerio meningum. Est novum quoddam genus vasorum. *Nam sicut in transfusione a venis in arterias, est in pulmone novum genus vasorum, ex vena et arteria*: ita in transfusione ab arteriis in nervos est novum quoddam genus vasorum ex arteriae tunica in meninge: cum praesertim meninges ipsae suas in nervis tunicas servent." [15] This suggests that Servetus visualized the blood as passing from the pulmonary artery via some kind of linking vessel, made up by vein and artery, directly into the pulmonary vein.

Summary

The contrasting views of Ibn an-Nafīs and Servetus may be stated as follows:

1. Ibn an-Nafīs denies the existence of pores in the septum of the heart. Servetus is silent on this point and does not exclude the possibility of blood sweating through.

2. Ibn an-Nafīs thinks that the blood filters through the wall of the pulmonary artery, mixes with the air in the lungs, and then filters into the pulmonary vein. Servetus believes that the blood passes from the pulmonary artery into the pulmonary vein by way of intermediate vessels.

If these interpretations are correct it would mean that in two rather important anatomical details Servetus differed from Ibn an-Nafīs. This difference in its turn would give support to the belief that he had no knowledge of his Arabic predecessor.

[15] *Ibid.*, pp. 171-172. (Italics mine.)

Entrance to St. Joseph's Hospital, Lisbon.

OPENING DAY AT THE ROYAL SURGICAL SCHOOL OF LISBON, ON NOVEMBER 5TH, 1828

AUGUSTO D'ESAGUY, M. D.

In the year 1828 a very curious and rare pamphlet was printed, with the sanction of the Court of Justice, under the heading of "Report on the Proceedings at the Opening of the Royal Surgical School of Lisbon, on the Fifth of November, and Bestowal of the Royal Prize on the School's most distinguished Pupil. November 1828. By Permission of the Court of Justice."

This quaint pamphlet, which has 16 pages, gives a detailed account of the ceremony which took place at 11 A. M. in the School Hall, comprising the opening of the School Year and the bestowal of the Royal Prize, awarded to the most brilliant pupil by King Michael, a generous patron of scientific institutions in Portugal.

The Royal Prize consisted of "a precious box of the latest instruments for the operation of the lachrymal fistula and cataract, brought by His Majesty from Vienna."

Prof. Silva Carvalho[1] refers to Lima Leitão's "Opening Day Speech at the Royal Surgical School of Lisbon on November 5th 1828."

I think this pamphlet is worth transcribing, being a curious addition to the history of the Royal School and St. Joseph's Hospital. It tells us that year's Opening Day speech was delivered by Antonio José de Lima Leitão, Pathology Lecturer, and that the pupils who received prizes were: Francisco Ildefonso Gromicho Couceiro (1st year), João Pais da Cunha (3rd year), Rodrigo Maria de Carvalho (4th year), and João Tavares de Macedo (5th year).

The Royal Prize was awarded to João Tavares de Macedo, who was presented to King Michael two days later, accompanied by the School Chaplain, the Principal and Lecturing Staff, composed of:

Jacinto José Vieira (†1829),
Manoel Carlos Teixeira (1802-1877),
José Cordeiro (1781-1850),

[1] Silva Carvalho: *A Regia Escola de Cirurgia de Lisboa*, pp. 80 and 154.

Antonio Pedro Cardoso (1792-1839),
João José Pereira (1793-1848),
Joaquim José Fernandes (†1834),
Francisco Tomás da Silveira Franco (1797-1849),
José Lourenco de Luz Gomes (1800),
João Pedro Barral (1805-1862),
Joaquim da Rocha Mazarem (1775-1849),
Antonio Joaquim Farto (1783-1856),
Antonio José Vieira (†1839),
Antonio José de Lima Leitão (1787-1856) and
Antonio de Sousa Delgado (1795-1844).

The opening speeches, delivered by the School Chaplain and Antonio José de Lima Leitão, give us an idea of the position of Portuguese medicine at that period and of the state of development of St. Joseph's Hospital, founded by King Manuel I, as also of the interest with which the Royal Family watched the progress of the Royal Surgical School.

" It is always a memorable occasion when Scientific Schools, gradually unveiling the knowledge entrusted to their keeping, celebrate the re-opening of their period of study. The Royal Surgical School of Lisbon has devoted itself with particular zeal, since its recent foundation, to fostering a love of science, by rewarding the diligence and attainments of its most talented pupils.

" In the Annals of the School, the 5th of November 1828, which marked the opening of the present School Year, will shine with greater brilliancy; a Royal Prize has lent it particular interest, and the pupil who has most distinguished himself by his behaviour, diligence and talent during the preceding year, has been fittingly rewarded.

" This gift, which will stimulate effort and initiative, augurs precious fruits for the well-being of Mankind. Such is the magic power of Royal favour and generosity! How gently and yet how rapidly under its influence talent develops and multiplies and science progresses and spreads. What prodigious benefits have been bequeathed to posterity by Octavius Augustus and Leo X, as a result of their generous encouragement! How useful was the help

given by Charles I to the immortal Harvey, which enabled him to demonstrate the principles of blood-circulation. That ill-fated King surely deserves to be remembered in connection with that fundamental discovery.

" What brilliant lights, what exhaustive investigations were awakened by the munificence of Louis XV, scattered open-handedly over the Surgical Academy of Paris! With Royal magnificence and liberality did the Emperor Joseph II endow, in 1785, the Imperial Military Surgical Academy of Vienna, to which gratitude has given the name of Josephine Academy.

" Glory and Immortal Grace to our beloved Sovereign who, inspired by the wish to quicken every useful branch of knowledge, has entrusted to this Royal School a precious reward, to be conferred on its most distinguished pupil. This landmark will be the sparkling source from which the Surgical School will draw everlasting encouragement for its work and advancement.

" The School is therefore carrying out a very welcome duty in publishing the record of the solemn proceedings which accompanied the bestowal of the Royal Prize.

* * * *

" On the fifth of November of the present year, at eleven o'clock, this memorable act took place, witnessed by a large gathering, which filled the great School Hall.

" On a dais were seated the Principal and Lecturing Staff, headed by the Revd. Chaplain Camara, Warden of St. Joseph's Hospital, as well as other distinguished men who had been specially invited or wished to honour the proceedings with their presence.

" Beneath the portrait of King John VI was seated, in his priestly robes, the Revd. Chaplain, specially appointed by His Majesty to bestow the Royal Prize. On his left stood a table covered with a velvet gold-embroidered cloth, on which reposed a tray of silver filigree containing the Royal Prize, covered with a golden cloth. On the other side sat the pupils who had most distinguished themselves.

" The Opening Speech was delivered by Antonio José de Lima Leitão, Pathology Lecturer, who was seated on the Chaplain's left, behind a table covered with crimson damask. After giving a detailed

account of the work accomplished during the year, and urging the pupils to further diligent and eager study, he alluded enthusiastically to the King's munificence.

" Thereupon the Revd. Chaplain read out the names of the pupils who deserved special praise. They were:

> In the first year, Francisco Ildefonso Gromicho Couceiro,
> in the third, João Pais Cunha,
> in the fourth, Rodrigo Maria de Carvalho, and
> in the fifth, João Tavares de Macedo.

" The Prize consisted of a precious case of surgical instruments, to be used in operating the lachrymal fistula and cataract, specially brought by His Majesty from Vienna to reward the School's best pupil.

" Thus were the proceedings closed, leaving in all those present a feeling of deep respect and admiration for the Sovereign who, even in far-away countries, had shown his interest for the advancement of his People.

" Then, as the Revd. Chaplain, Principal and Teaching Staff were anxious to express to His Majesty their humble gratitude and to present to him the Pupil whose merit had been rewarded, they met on the seventh of November, at one o'clock at the Necessidades Palace, to kiss the Royal Hand, and were shown into the Throne Room, where His Majesty awaited them, attended by his Lord-in-Waiting, the Marquis of Bellas.

" The King's reception was extremely amiable, His Majesty advancing a step at each of the three obeisances made by the visitors, and, when all had kissed the Royal Hand, the Revd. Chaplain read out the following Address, to which the King listened with marked attention.

* * * *

" ' Most High and Powerful Lord, our King.

" ' The Teaching Staff of the Royal Surgical School of Lisbon kneels at your Royal Feet, to render sincere and respectful thanks for the honour Your Majesty has recently conferred on it by awarding a most precious Royal Prize to the Pupil whose diligence, attain-

ments and behaviour have been considered most remarkable, thus clearly showing the interest Your Majesty takes in the progress of the branch of Science most useful to Mankind, and how dear the Royal Surgical School is to Your Majesty.

"'Sir, this precious Gift, with which you have honoured the Royal School, this example, rare in the Annals of Science, will mark a new Period and will be engraven in our hearts as proof of Your Majesty's generosity, greatness and mercy.

"'Sir, in the Royal Hospital of St. Joseph will ever be gratefully remembered the glorious names of King Manuel, its founder, King John III, who completed the building, King John V, who endowed it with generous monthly grants from his Royal Purse, likewise endowing the first Chair of Anatomy, King Joseph, Queen Mary and King John VI, who greatly increased the Hospital's income, also granting special privileges and adding numerous wards, as well as endowing the Chairs for Operations and Childbirth, thus greatly stimulating surgical study in this country.

"'Finally, Your Majesty's distinguished Father gave the Hospital its present organization, and deigned to be present with the Princesses on the happy Re-opening Day.

"'Wherefore, Sir, your Royal Person will likewise be gratefully remembered, not only as the supporter of this House of Mercy, protecting it against the machinations of its mischievous detractors, but also as One who, by his generosity, openly proclaims his fatherly affection for an Institution so useful and necessary to Mankind, thus encouraging its members, by their diligence, attainments and behaviour, to show themselves worthy of recognition at the hands of their Sovereign.

"'We beseech you, Sir, to accept our grateful thanks for this great honour, and to permit us to kiss your Royal Hand, over which, in our name and in that of all those we represent, we joyfully renew our protestations of love, gratitude and loyalty to the best of Sovereigns, this honour being shared by the Pupil who, by his industry and exemplary conduct, has been unanimously pronounced worthy of the Prize with which Your Majesty has honoured the Royal Surgical School, which will strive to deserve Your Majesty's High Protection and Royal Bounty.

" ' May the Merciful Heavens accept our earnest prayers and prolong Your Majesty's precious and useful Life, prospering your Rule for many years, for the happiness of your Subjects and the advancement of the Royal Surgical School and St. Joseph's Hospital.'

" His Majesty replied as follows:

" ' I thank the Revd. Chaplain for the loyal sentiments he has just expressed in his own name and in that of the Royal Surgical School. I hope they will carry out their duties as devotedly as they have done up to now, and I will not fail to show, on every occasion, my affection for the Royal School and St. Joseph's Hospital.'

" Whereupon the Revd. Chaplain and other gentlemen again kissed the Royal Hand, after which His Majesty deigned to converse with his visitors, clearly revealing, by his gentle condescension, his affection for the Royal School and Hospital.

" After which, making deep obeisances, they left the Throne Room, while His Majesty gracefully waited until all had left. Such were the benefits and proof of his Royal Favour, bestowed by the King on the Royal School and Hospital in the space of a few days.

" The Royal Surgical School and the Hospital to which it is closely bound will strive to show themselves worthy of His Majesty's esteem and protection, and will not cease to proclaim the graceful benefits and distinctions with which His Majesty has deigned to stimulate and reward an Institution so useful to Mankind.

Dum juga montis aper, fluvios dum piscis amabit,
Dumque thymo pascentur apes, dum rore cicadae,
Semper honos, nomenque tuum, laudesque manebunt."

* * * *

Necessidades Palace,
October 17th 1828.

To the Revd. Chaplain Camara.

Sir,

The King our Lord has directed me to forward you the enclosed Box of Instruments for the Operation of Cataract, to be awarded

as a Prize to the Pupil of the Royal Surgical School of St. Joseph's Hospital who shall most distinguish himself in this year's examination. His Majesty hopes the recipient will have given proof, not only of constant diligence and devotion to study, but also of exemplary behaviour. Of which by His Majesty's order I acquaint you, so that the King's wishes be duly carried out.

May the Lord Bless and Protect you.

Baron of Queluz.

* * * *

Necessidades Palace.
November 5th 1828.

To the Revd. Chaplain Camara.

Sir,

The King our Lord has deigned to permit that you present to Him, on the seventh of this month, at one o'clock, at this Royal Palace, the Principal and Teaching Staff of the Royal Surgical School of this Court, as well as the Pupil to whom the Royal Prize has been awarded. Of which I acquaint you so that His Majesty's wishes be duly carried out.

May the Lord Bless and Protect you.

Baron of Queluz.

THE LIBRARY AND MUSEUM OF THE DEPARTMENT OF MEDICAL HISTORY AT THE UNIVERSITY OF KANSAS

The Department of Medical History of the Medical School of the University of Kansas was given new quarters last year and since October, 1939, has occupied an entire floor in the Hixon Laboratory for Medical Research. A generous donation has permitted the building and furnishing of a library, museum cases and a lecture room; there are also two study rooms for research.

Dr. Logan Clendening, who has conducted the class in medical history for over fifteen years, presented the University with his library of works relating to the history of medicine and the basic sciences. He also presented a number of objects of historical interest to the museum. These have been augmented by a very handsome and comprehensive collection of Chinese objects and books on Chinese medicine, the gift of Dr. M. W. Pickard of Kansas City, and a collection of early nursing bottles and surgical instruments, the gift of Dr. E. H. Hashinger.

The library has been collected with the object in mind of putting it to exactly the use it now serves, so it represents quite a comprehensive collection of classic and oriental medicine as well as a collection of anatomy, physiology, pathology, bacteriology, medicine, surgery, obstetrics, and the specialties. The basic sciences, anthropology, folklore and superstition are adequately covered.

Only occasionally did the personal preferences of Dr. Clendening carry him away from his object of making a well balanced collection, suitable for teaching purposes, but the collections of Harvey, Vesalius, early anatomy, Paré and Auenbrugger are worthy of a special note. The 1628 Harvey is a thick paper copy and has one of the finest provenances of any such item. The Geminus and rare two-volume second edition of Vesalius, the "Cinq Livres" of Paré in mint state, two editions of the "Inventum Novum," Edward Jenner's copy of Johnson's "Dictionary," the William Beckford copy of Gesner's "Historia Animalium," Dalton's "New Chemical Phi-

losophy " in the original state, exceptional copies of the early bacteriological classics and a collection of monographs on Arabian medicine by Wiedemann are favorite objects for exhibition.

Also valuable is the anaesthesia material. It is the result of the labors of two collectors, one a Southern admirer of Crawford Long and one a Harvard graduate, loyal to Morton, Wells and Jackson. These were bought intact and much material on local anaesthesia, spinal anaesthesia, Simpson and John Snow has been added.

The department of Americana has been particularly developed, following Dr. Clendening's idea that research in medical history in America should emphasize the American contributions. One item of especial interest is Thomas Miner's copy of Nathan Smith's Essay on Typhus Fever with his pencilled and quite sarcastic notations in the margin. Early Missouri and Kansas items are highly desired as additions.

Noteworthy specimens in the Museum are a complete collection of touch pieces of all the monarchs of England from Edward IV to James II (also the old Pretender's, made of pewter), the Chinese acupuncture figures, and diagnostic compass, the 18th century obstetrical chair and a collection of black letter acts appointing fast days for the plague and days for touching for the evil.

The collections are available for research by any qualified person. A catalogue is being prepared and although it will probably not be ready for printing for at least a year, applications for it will be received and filed now and the catalogue sent out to applicants as soon as it is completed.

The course in medical history is given once a week during the senior year. It consists of lectures given by a staff of seven members of the faculty and this year four distinguished visitors, viz: Dr. Sanford V. Larkey of Johns Hopkins, Dr. John F. Fulton of Yale, Dr. Henry E. Sigerist of Johns Hopkins, and Dr. Chauncey D. Leake of the University of California.

L. C.

Fig. 2 — General view of the lecture room

Fig. 4. View of a Museum case showing exhibition of Chinese medicine

Fig. 5. View of a Museum case showing the evolution of the Microscope.

ANNOUNCEMENTS

American Association of the History of Medicine

The Association held a very successful annual meeting in Atlantic City on May 6. Professor Arturo Castiglioni delivered the first Fielding H. Garrison Lecture on the subject of "A. Cornelius Celsus as a Historian of Medicine." Twelve papers were read during the three sessions. They will be published in the July number of the *Bulletin*.

At the business session the Association elected unanimously and with great enthusiasm the following scholars as *honorary members*: Professor Juan Ramon Beltran, Universidad de Buenos Aires, Argentina; Professor J. J. Izquierdo, Escuela Medico Militar, Mexico City; Dr. Carlos Enrique Paz Soldán, Instituto de Medicina Social, Universidad de San Marcos, Lima, Peru.

The Association amended the Constitution in various parts. A *corresponding membership* was instituted in order to give scholars who are neither citizens nor residents of the United States and Canada the opportunity to join the Association.

Preceding the annual meeting the Council of the Association held a meeting on May 5 which was attended by 48 members of the Council and of the Association. Reports were presented by the officers, the committees, and the constituent societies.

The Ohio Committee on Medical History and Archives was elected as constituent society. The Association now has 17 constituent societies and various further applications are pending.

The Association will hold a fall meeting on October 7, 1940 in Cleveland, Ohio under the auspices of its constituent society, the Ohio Committee on Medical History and Archives with Dr. Howard Dittrick as local chairman.

The minutes of the Council meeting and of the business session of the annual meeting will be published in the July number of the *Bulletin* which will be devoted entirely to the transactions of the Association.

CONSTITUENT SOCIETIES

The Walter Jarvis Barlow Society of the History of Medicine.

Testimonial Dinner to Dr. George Dock on his Eightieth Birthday. On the evening of April 2, 1940 at a dinner at the headquarters of the Los Angeles County Medical Association, Dr. George Dock, surrounded by some seventy of his friends, colleagues and former students, celebrated his eightieth birthday. Although his real birthday falls on April 1st, a happy conjunction of events led to its celebration on April 2nd. These events were the founding of the George Dock Lectureship by the Walter Jarvis Barlow Society of the History of Medicine, and its initiation by Dr. Dock himself as the first lecturer.

The celebration was therefore in the nature of a triple birthday—the birth of the Walter Jarvis Barlow Society of the History of Medicine whose first public meeting it was, the birth of the George Dock Lectureship in the History of Medicine, and the eighth birthday of Dr. Dock.

After three powerful puffs which disposed of the eighty lighted candles surrounding his birthday cake, Dr. Dock was permitted to sit back and listen to the many messages from all parts of the United States and Canada. There was a message from Charles Perry Fisher of Philadelphia, who for many years was Librarian of the College of Physicians and whom Dr. Dock called " the first medical librarian " he had ever seen, reminding him of his first years as a medical student in Philadelphia. There was a message from Dr. Rock Sleyster, President, and Dr. Alphonse McMahon, Vice-President of the American Medical Association; from Dr. George H. Kress, Secretary of the California Medical Association; from Dr. Roy E. Thomas, President, Dr. Paul Ferrier, Vice-President, and Dr. L. A. Alesen, Secretary of the Los Angeles County Medical Association; from Dr. Elizabeth Mason Hohl, President Elect of the American Medical Women's Association; and from Dr. H. E. Schiffbauer, Chairman of the Library Committee of the Los Angeles County Medical Association.

Then from the various institutions where he had taught, there were warm reminders that he still lives in the memory of those with

whom he worked, and that the monuments he built in teaching, organization and friendship still stand. Thus there was a message from Dr. Alexander Ruthven, President of the University of Michigan; from Dr. C. C. Bass, former Dean of the Medical School of Tulane University, New Orleans, who was most closely associated with Dr. Dock while he was in New Orleans; and from many friends on the faculties of these institutions who expressed their happiness at having known Dr. Dock, and their appreciation of the good influence he had on their lives, many dating this influence back as long as forty years. From St. Louis came greetings from colleagues, friends, students and librarians with whom he had been intimately associated during his teaching period there.

From his associates in Los Angeles, several of whom had known him since the days of his occasional visits to southern California, which began in 1903, and from others who knew him since he came to settle permanently in 1923, there were messages of felicitation and of appreciation of their good fortune in having him here and wishing him, as he wished himself, "to live as long as Old Parr."

It was recalled by some that as long ago as 1907, when the Barlow Medical Library was dedicated, Dr. Dock, then in Ann Arbor, sent a gift of a rare book to commemorate the occasion. This work, as Mrs. Mary E. Irish, the present Librarian of the Los Angeles County Medical Association, which took over the Barlow Medical Library in 1934, pointed out, was the beginning of a constant stream of gifts to the library, which seems to be increasing in volume as the years go by.

Dr. Milbank Johnson, one of Dr. Dock's earliest acquaintances in southern California, and the first librarian of the Barlow Medical Library, spoke of the valuable spiritual incentive which Dr. Dock has given to the library since its founding.

Mrs. Barlow, happily present, spoke of her pleasure in knowing that Dr. Barlow had a spiritual heir in Dr. Dock, whose interest in the library carries on the tradition which Dr. Barlow wished to have continued.

The roll of former students of Dr. Dock was then called and five answered present, four from St. Louis and one from Ann Arbor who graduated forty years ago.

A letter from Dr. C. N. B. Camac, kindred spirit in the history of medicine, traced Dr. Dock's medical ancestry to the great medical diagnosticians, Louis and Osler.

From Dr. Archibald Malloch, Librarian of the New York Academy of Medicine, fellow Charaka Club member, and fellow Medical Library Association member, a nostalgic letter was read recalling Dr. Dock's attendance at their meetings.

From Dr. Maude Abbott there was a message recalling Dr. Dock's days as a medical student in Philadelphia, when began the famous friendship with Dr. Osler, the spirit of which all who have known Dr. Dock soon learn to recognize.

From Dr. W. W. Francis, Librarian of the Osler Memorial Library and literary heir of Dr. Osler at McGill, came a greeting both as friend and fellow librarian.

From Colonel Harold W. Jones, Librarian of the Army Medical Library and President of the Medical Library Association, came a greeting and this quotation from Horace, his own translation:

> I have finished a monument more enduring than bronze
> More lofty even than the royal pyramids
> Which neither the erosions of the tempest,
> Nor the power of the North Wind can destroy,
> Nor Time itself obliterate,

which expressed for all those present Dr. Dock's place in the hearts of all who have known him.

Dr. Harlan Shoemaker, Trustee of the Los Angeles County Medical Association and particular friend of the Library, in his greeting presented the following quotation from Lucretius:

> No single thing abides, but all things flow.
> Fragment to fragment clings; the things thus grow
> Until we know and name them. By degrees
> They melt, and are no more the things we know.
>
> Globed from the atoms falling slow or swift
> I see the suns, I see the systems lift
> Their forms; and even the systems and their suns
> Shall go back slowly to the eternal drift.

Before leaving the table Dr. Burrell O. Raulston, Professor of Medicine at the University of Southern California, expressed for

those gathered their appreciation of the great good fortune which led Dr. Dock to us and wished him, as all did, many long years of his good life.

The gathering then adjourned to the Library of the Los Angeles County Medical Association where Dr. Dock, with characteristic gentle humor, expressed his happiness at the many messages from far friends and the felicitations of those about him. Following this, Dr. Dock, having chosen to speak on the History of Medical Encyclopedias as the subject for the first of the George Dock Lectures, illustrated his talk with a few of the many gifts which he invariably bears at each of his frequent visits to the Library.

At the conclusion of the lecture, Dr. Donald A. Charnock, President of the Barlow Society, announced the plan to publish the lecture and other contributions to this triple celebration in a commemorative volume of suitable format. Thus was ended an inspiring evening which can come only infrequently in the life of any man.

HYMAN MILLER, M. D., *Secretary*

The Johns Hopkins Institute of the History of Medicine, Baltimore, Maryland.

Professor Heinrich Zimmer, formerly professor of Indian philology at the University of Heidelberg and recently lecturer in Oxford, has accepted an invitation to deliver the *Hideyo Noguchi Lectures* during the academic year 1940-1941. Professor Zimmer is the author of several books dealing with the philosophy and religions of India. The subject of his lectures will be " Indian Medicine."

Professor Zimmer will be available for lectures in other institutions next autumn and winter.

The letters and papers of the late *John Jacob Abel* have been deposited in the Institute of the History of Medicine for cataloguing. The Institute would greatly welcome any letters written by him prior to 1915. They will be transcribed and promptly returned. Please communicate with Miss Helen T. Konjias, Institute of the History of Medicine, 1900 East Monument Street, Baltimore, Md.

NATIONAL NEWS

Detroit, Michigan.

One of the members of the Library Staff of the Detroit Library Commission has made an index of Detroit and Michigan medical history. She has gone through Michigan periodicals page by page for items of biography and history and used what source material is to be found in the Historical Library in Detroit and in the University of Michigan Library. She expects to write her thesis for her Master's degree on Medical History of Detroit, so eventually there will be a very complete bibliography on Detroit medical history and a fair one on Michigan. In the meantime, this material is indexed on cards but the information is available for anyone needing it through Marjorie J. Darrach, Chief, Medical Science Department, Detroit Library Commission, 645 Mullett Street, Detroit, Michigan

Jefferson, Ga.

On April 8, 1940 the 2-cent stamp of the series " Famous Americans " honoring Crawford W. Long was first issued in Jefferson, Ga. The event was celebrated in a meeting attended by medical and political leaders of the region.

Philadelphia, Pa.

The Old Autopsy House of the Philadelphia General Hospital (" Old Blockley ") has been restored as the Osler Memorial Building. It will be dedicated on June 8. At the same time there will be a premier showing of the painting " Osler at Old Blockley " by Dean Cornwell.

New England Renaissance Conference.

On April 12-13 a conference on Renaissance Studies for scholars in the New England region will be held at Brown University, Providence, R. I. under the auspices of the Committee on Renaissance Studies of the American Council of Learned Societies. A session was devoted to *Science and Philosophy* at which R. M. Blake read a paper " The Theory of Hypotheses in Some Renaissance Astronomers."

FOREIGN NEWS

England.

Notice has been received of the death on March 9 of Dr. Robert Theodore Gunther. Dr. Gunther was born in 1869, the eldest son of Dr. Albert Gunther, F. R. S., and was educated at University College School, London, and at Magdalen College, Oxford, of which he was for a long time fellow and tutor. He was also university reader in the history of science. He was an honorary doctor of laws of St. Andrews. Robert T. Gunther published a large number of monographs dealing with the history of science among which are 13 volumes on Early Science in Oxford, 2 volumes on the Astrolabes of the World, 2 volumes on Robert Hooke, several volumes on early scientific instruments and many other most valuable publications. The history of science has suffered a great loss.

ADDENDA

From a letter of Professor Lynn Thorndike: *Dr. W. W. Francis of the Osler Library recently called my attention to the identity of the Symeon, a master of Antioch, mentioned at page 366 of my article, "Three Tracts on Food in Basel Manuscripts,"* Bulletin of the History of Medicine, *VIII, 1940, with Symeon Seth, whose work on foods was printed in 1538 in Greek with the recent Latin translation of Lilius Gregorius Gyraldus of Ferrara* (Symeonis Sethi magistri Antiochiae syntagma per literarum ordinem de cibariorum facultate Lilio Gregorio Gyraldo Ferrariensi interprete, *Basel apud Mich. Isingrinium, MDXXXVIII*) *and again in Greek only by Teubner in 1868, ed. Bernhardus Langkavel.*